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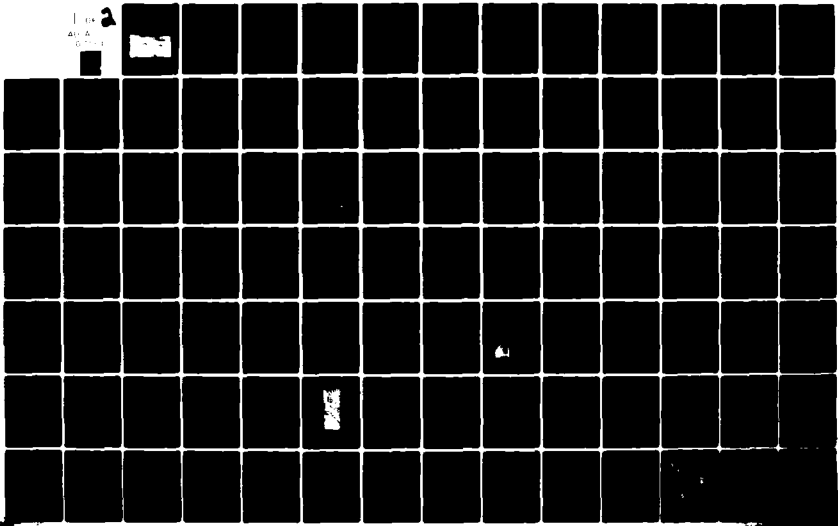

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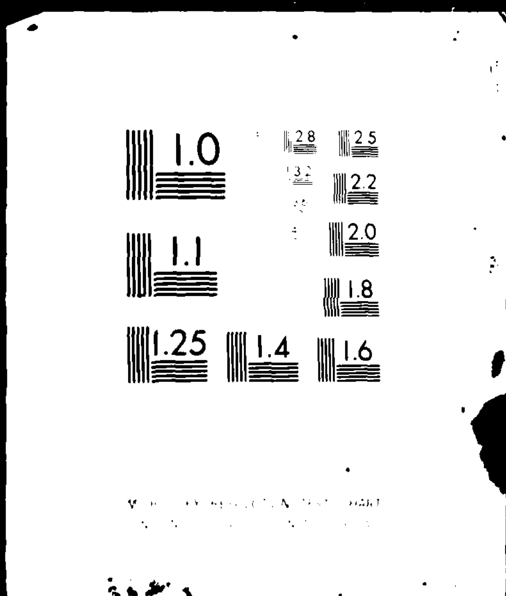

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CULTURAL RESOURCES INVESTIGATIONS AT REDSTONE ARSENAL MADISON COUNTY, ALABAMA

Volume I

Edited by
Prentice M. Thomas, Jr.

New World Research, Inc.
Report of Investigations No. 35
1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 35	2. GOVT ACCESSION NO. AD-A107 151	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Cultural Resources Investigations at Redstone Arsenal, Madison County, Alabama		5. TYPE OF REPORT & PERIOD COVERED Final 1979 - 1981
		6. PERFORMING ORG. REPORT NUMBER 35
7. AUTHOR(s) Prentice M. Thomas, et al		8. CONTRACT OR GRANT NUMBER(s) DACW01-79-C-0024
9. PERFORMING ORGANIZATION NAME AND ADDRESS New World Research, Inc. PO Box 410 Pollock, Louisiana 71467		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS SAMPD-EC US Army Corps of Engineers, Mobile District Mobile, AL 36628		12. REPORT DATE 1980
		13. NUMBER OF PAGES 499
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) same as 11		15. SECURITY CLASS. (of this report) unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE unclassified

16. DISTRIBUTION STATEMENT (of this Report)

unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

unlimited

18. SUPPLEMENTARY NOTES

Prepared as part of the overall DDT contamination study conducted by Water and Air Research, Gainesville, Florida, for the Mobile District, US Army Corps of Engineers

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Cultural resources, archeology, prehistoric, historic, geomorphology, Wheeler Basin, predictive model

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

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Block 20. Abstract (Continued)

Paleo-Indian through the Historic Period. A predictive model of site location, based on environmental variables, was formulated and resulted in the determination of high, medium, and low probability areas for site occurence.

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CULTURAL RESOURCES INVESTIGATIONS

AT THE

REDSTONE ARSENAL,

MADISON COUNTY, ALABAMA. Volume I.

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~~Final rept~~
1979-1981

(15) DACW01-79-C-0014

For

Mobile District, U. S. Army Corps of Engineers

Under Contract With
Water and Air Research, Inc. 391616

New World Research, Inc.
(14) Report of Investigations No. 35 (Final) 1979-1981

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(12) 170

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ABSTRACT

A reconnaissance level cultural resources survey and program of testing and evaluation in the proposed alternate corridor of the DDT Contamination Study, Wheeler Reservoir, Redstone Arsenal, Alabama, resulted in the identification of 22 new sites and the testing of 26 previously recorded or newly discovered sites. The program of testing and evaluation was augmented by deep-testing to determine the area's geomorphic history and to assess the possible presence of buried sites. No buried sites were encountered; however, the testing program and subsequent analysis identified occupation in the study corridor from the Paleo-Indian through the Historic Period. A predictive model of site location, based on environmental variables, was formulated and resulted in the determination of high, medium, and low probability areas for site occurence.

ACKNOWLEDGEMENTS

The successful completion of any project is achieved only through the combined efforts of many people. The scope of the Redstone Arsenal cultural resources survey and testing program was such that without the patience, perseverance, and enthusiasm of all persons involved in the work, the project would not have achieved the degree of order and completeness that it has. Although we do not have the space here to mention every person who worked with and assisted us, a number of individuals' contributions were such that they deserve a special acknowledgement.

Foremost we would like to thank our contracting firm, Water and Air Research, Inc., of Gainesville, Florida, for providing us with the opportunity to become involved in the archaeological portion of their environmental impact study. Specifically, we would like to acknowledge the assistance and coordination of William Zegel and Jim Sullivan.

The overall project was conducted for the U.S. Department of the Army and administered through the Mobile District Corps of Engineers. The Cultural Resources staff of that District provided us with considerable help and cooperation. Although we appreciate the efforts of all individuals in that office, a special note of thanks goes to Dottie Gibbens, Jerry Nielsen, Ernie Seckinger, and Charles Moorehead. Of the other Corps personnel, we would like to specifically thank Emery Baya for his assistance on several occasions.

Part of the project corridor includes land under the jurisdiction of the Tennessee Valley Authority. J. B. Graham and John Coverdale eased the way for our access on that property.

At the Redstone Arsenal, we received information, photographs, and general data from a group of individuals. To all of those people who assisted in the various stages of the project, we say thank you. To one individual, William Schroeder, we offer special thanks for supplying us with maps, clearance, and access to large areas of the Arsenal.

The Office of Archaeological Research, University of Alabama, supplied an invaluable wealth of information concerning previous investigations in the study area, specifically those dealing with the WPA work. Special mention must be made of Carey B. Oakley, Director of the Office, who lent us original maps and notes, and arranged for the curation of the artifactual material. In addition, we were provided information by the Moundville Museum, Moundville, Alabama. To the personnel of that museum, we are especially grateful.

It is customary to acknowledge the crew, be it laboratory or field, with some catchy phrase. The crew, however, worked too hard and too long to dismiss with levity a serious effort. They know their contribution; we can only offer our thanks to: Donald P. Pfeiffer, Thomas D. Montagne, Kathy Bagley-Baumgartner, Patrick O'Brien, Marty Calvert, David Zeanah, Kay Moneyhun, Archie Stapleton, Richard Brooks, Cesar Lopez, Karen Sultenfuss, Michael Nash, Mark Swanson, and Michael Bladel. In addition to these persons, the project enjoyed the involvement of Lawrence Alexander for part of the fieldwork. Mr. Alexander assisted with access and provided information on sites. He knows the area well, having been responsible for conducting an earlier survey at the Arsenal.

Contributors to these volumes include Jeffrey Altschul, L. Janice Campbell, Carol S. Weed, Kathy Bagley-Baumgartner, and John P. Lenzer. Each of these persons made what I consider a valuable contribution to the data interpretation, general understanding of the project area, and clarity of the project results.

Finally, mention should be made of the individuals who assisted in areas of the report preparation: editing-Susan Fulgham; general financial organization-Yvonne Hodnett; typing-Ann Sanders and Jeanne Cortinas; and final typing, Renee Morrison. Perhaps, seeing the size of this report, the last three deserve special honors.

1. INTRODUCTION

In January, 1980, New World Research, Inc., under subcontract with Water and Air Research, Inc., inaugurated a reconnaissance level cultural resources survey and a program of testing and evaluation in the proposed alternate corridor of the DDT Contamination Study, Wheeler Reservoir, Redstone Arsenal, Alabama. The work was conducted for the U.S. Department of the Army, Mobile District Corps of Engineers. The archaeological investigations are part of a broader environmental impact study on DDT contamination and possible alternate corridors to relieve the impact of contamination in the region.

The study area consists of a corridor measuring approximately two miles (3.2 km) by five miles (8 km), and encompasses Federal and privately owned land in Madison County, Alabama. The western half of the corridor lies within the Redstone Arsenal. The study area is bounded on the south by the Tennessee River and on the north by Martin Road. The western boundary loosely conforms to Patton Road, while the eastern boundary is more nebulous and erratic, but generally follows a line which is created by the eastern boundary of the Byrd Spring Rod and Gun Club and the western slope of Bell Hill.

The area is characterized by flat alluvial terraces, gently undulating uplands, and well defined drainage basins. The latter are composed of swamps, bottomland knolls, and slightly elevated alluvial bottomlands (see Chapter 6). During the historic period, the predominant land-use pattern was agricultural; however, in the last forty years the pattern has been altered. The establishment of Redstone Arsenal reduced the role of agriculture in the area, and subsequent population growth has seen the development of extensive housing complexes onto the agricultural land (see Chapter 4). The latter has had special impact upon the archaeological resources of the area; at least two known sites (1Ma170 and 1Ma188) were destroyed or endangered by suburban growth.

Archaeologically, the area is part of the Middle Tennessee River Valley culture region which includes portions of middle Tennessee and northern Alabama (Figure 1). Prior to the project, the majority of information concerning sites within the study area was the result of work conducted during the WPA era and recent investigations by Alexander (1979) in selected portions of the Redstone Arsenal.

Services Performed Under This Contract

As outlined in the project scope of work, the objectives of the cultural resources study included a thorough literature and background search with special emphasis on the resources of the Wheeler Basin, a statistically valid sample survey of portions of the study corridor, an evaluation of known and selected newly discovered sites in the corridor, mechanical trenching to determine geomorphic history and to

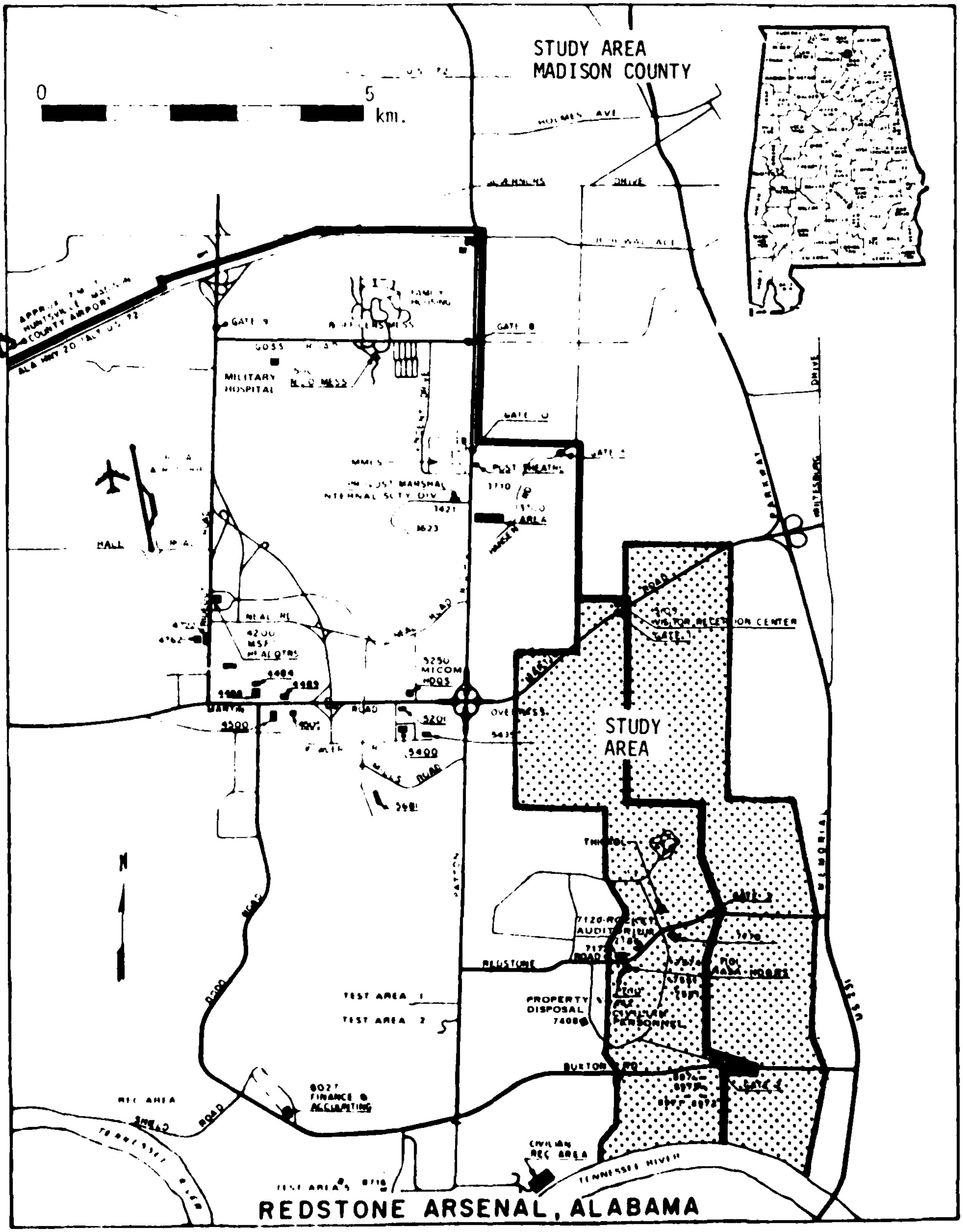

FIGURE 1. MAP SHOWING STUDY AREA IN RELATION TO REDSTONE ARSENAL.

assess the potential for buried sites. The ultimate goal of the project was the development of a predictive model of site location with the aim of making recommendations for alternate corridors.

In order to implement the required work, the project was conducted in a series of four overlapping phases. The first phase encompassed a portion of the literature and background search and the development of the reconnaissance sampling strategy. The remainder of the literature and background search, which stressed data gathering for inclusion in support sections of the report was conducted during and after the field portion.

Data concerning the environment, geomorphology, previous investigations, culture history, historic period development, status of archaeological knowledge, and history of land use in the project area were compiled from several sources. The libraries of Huntsville, Alabama, the Peabody Museum of Harvard University, Texas A & M University, the University of Alabama, and New World Research, Inc. supplied the majority of information concerning the prehistory and history of the area, in addition to information on the geomorphology and general environment. Also consulted were the records of the Madison County-Huntsville Historical Society, the Redstone Arsenal Facilities Engineering Division and Public Relations offices, the Madison County Soil Conservation Service, the Moundville Museum, and the Madison County Courthouse. The Office of Archaeological Research, affiliated with the University of Alabama, and the Department of Anthropology at the University of Alabama provided additional information concerning previous work in the immediate project area. The National Register of Historic Places was consulted for any sites located within the project area. One site, the original Redstone Rocket test stand, was found to be on the Register although it is out of the study corridor (see Chapter 4).

The second phase of work was the reconnaissance survey of 20 percent of the study corridor. The survey units were selected prior to the beginning of the fieldwork and were chosen in a systematic aligned sampling procedure.

The third phase of work was a combination of deep-testing and test and evaluation of known sites and five newly discovered sites within the study corridor. The deep-testing was carried out under the direction of our consulting geomorphologist, John P. Lenzer.

The last phase involved the development of the predictive model, analysis of all artifactual material, the compilation of a management summary, and the final report preparation.

These volumes present the methodology and results of the work. They are divided between background sections and the fieldwork and interpretations. The first volume covers a review of prehistory, ethnohistory, history, geomorphology, and the research design. The second volume includes field methodology, site descriptions, interpretations, and recommendations.

2. PREHISTORIC ISSUES & CULTURAL DEVELOPMENT: A CRITICAL OVERVIEW

By

D. Bruce Dickson, Jr.

In a classic formulation published in the late fifties, Willey and Phillips (1958) divided the prehistory of the New World into five "historical-developmental" stages. The five-stage system which these authors defined consisted of a Lithic, Archaic, Formative, Classic, and Postclassic stages, each of which was defined by different configurations of cultural traits and subsistence or economic activities. Willey and Phillips' system provided integration and generality to the highly particularistic and regional scope of American prehistory as it was studied at that time. The system is still useful today; consequently, the following discussion of the prehistoric sequence in the present study area is organized in terms of their framework. In using Willey and Phillips' "stage" scheme, caution has been exercised to make the distinction between "stage" and "period" as defined by Rowe (1962). According to Rowe (1962:40), stages are "units of cultural similarity. Cultural units are assigned to the same stage because they share one or more features which have been selected as diagnostic of other stages" (1962:40).

He notes that stages may be simple or complex depending on whether one or many cultural features are used in their definition. He then goes on to distinguish a cultural period from a stage by defining the former as "a unit of contemporaneity". That is:

> Any two archaeological monuments or cultural units are to be assigned to the same period if there is some reason for regarding them as contemporary, regardless of how different they may be from one another. If there is some reason to think that a non-ceramic unit in one part of the area is contemporary with a ceramic unit in another, the two must be assigned to the same period in spite of the contrast in inventory.

In the Southeastern United States, native culture appears to have passed through three of Willey and Phillips' five stages. Broadly speaking, culture there was transformed from the Lithic to the Archaic to the Formative stages. Since their Classic stage was marked in part by the "beginnings of urbanism" (Willey and Phillips 1958:182), most scholars suggest that southeastern cultures never developed beyond the Formative stage. In addition to Willey and Phillips' three stages, I have further subdivided southeastern prehistory into 10 chronological periods (Figure 2). The names of these periods are of course derived from the familiar McKern or Midwestern Taxonomic system as it was reworked by Griffin (1952) in his classic synthesis of Eastern North American prehistory. We agree with Stoltman's assertion that these units are generally used as "stages" by eastern prehistorians in that

"rather than lumping together cultures of the same age regardless of formal properties (as periods do), they lump together cultures of similar formal properties regardless of age (as stages do)" (Stoltman 1978:708).

Stage	Period	Period Dates
Formative	Late Mississippian	A.D. 1200 - A.D. 1539
	Early Mississippian	A.D. 1000 - A.D. 1200
	Late Woodland	A.D. 400 - A.D. 1000
	Middle Woodland	100 B.C. - A.D. 400
	Early Woodland	500 B.C. - 100 B.C.
Archaic	Late Archaic	4000 B.C. - 500 B.C.
	Middle Archaic	6000 B.C. - 4000 B.C.
	Early Archaic	8000 B.C. - 6000 B.C.
Lithic	Paleo-Indian	12,000 B.C. - 8000 B.C.
	Early Lithic	Before 12,000 B.C.

Figure 2. SEQUENCE OF STAGES AND PERIODS FOR THE SOUTHEASTERN UNITED STATES ADOPTED FOR THIS STUDY.

In this discussion, however, these periods have been defined strictly in temporal terms and are meant to be read as periods in Rowe's sense, that is, as units of contemporaneity. Thus, if two sites in our area are considered to have been occupied at about the same time, they both date to the same period regardless of whether or not their cultural inventories are identical. One final taxonomic note: in light of Stoltman's masterful review of eastern temporal models and his suggested revision of the existing chronological scheme, we were tempted to adopt the model which he suggests as a means of organizing this work. We have decided not to do this, however, as this method of organization is relatively unfamiliar.

The Early Lithic and the Paleo-Indian Periods: Origins and Definitions

The earliest evidence of human cultural remains in North American prehistory appear to date to the latter part of the Pleistocene geological epoch. Cultures dating to this time block are considered by Willey and Phillips to fall within the "Lithic stage", which is characterized by at least two traditions (or substages) of stone tool manufacture (1958:79):

1. The so called "Pre-Projectile Point" (or early Lithic), characterized as consisting of "unspecialized and largely unformulated core and flake industries, with percussion the dominant, and perhaps only, technique employed.

2. The Paleo-Indian Tradition, characterized by industries exhibiting more advanced "blade" techniques of stoneworking, with specialized fluted or unfluted lanceolate points the most characteristic artifact types.

Following Rowe's distinctions between stage and period, we have divided these Pleistocene traditions into two sequential archaeological periods: the Early Lithic period, which begins at some unknown, but presumably early date in the Pleistocene and ends at 12,000 B.C.; and the Paleo-Indian period, dated from 12,000 B.C. until 8000 B.C.

The Early Lithic Period

The Early Lithic period is poorly understood in terms of temporal duration and the associated cultural inventory. Lacking projectile points, this period is characterized by crude, basically chopper, tools. Unfortunately, the very limited data from the Southeast do little to alter the state of affairs regarding our present understanding of the Early Lithic period. The period is perhaps represented in certain problematic surface finds which generally lack clear stratigraphic association. These crude tools, and perhaps tool complexes, have been collectively called the "Lively Complex", and have been reported from Tennessee (Josselyn 1965; Dragoo 1965, 1973), Alabama (Lively 1965; Josselyn 1967), Louisiana (Gagliano 1963), and elsewhere in the Southeast (Dragoo 1967:5-8).

In the absence of projectile points, Lively Complex materials consist primarily of crude core choppers, scrapers, planes and denticulates, together with large unifacial flake or blade tools, all of which were fashioned by direct percussion. These tools were commonly made of a distinctive yellow chert or jasper (Josselyn 1965:5). Despite their simplicity, the specimens are definitely the product of human manufacture. However, since the materials have not been found in stratigraphic context, the dates of the Lively Complex remain uncertain. In general, they are consistently associated with high river terraces and other geologically old landforms. These locations, combined with the crudeness of their workmanship, have been taken as indicating that they are of great antiquity (Dragoo 1976:5-8).

Interpretations of Lively Complex materials vary widely. On the one hand these, as crude assemblages found elsewhere, may represent a migration of early peoples into the New World in advance of the Paleo-Indian peoples who followed and ultimately supplanted their predecessors at the end of the Pleistocene. In this scenario, little or no direct evolutionary relationship would probably exist between the Early Lithic and Paleo-Indian industrial traditions. On the other hand, these assemblages may represent a tradition which was derived from the same ancestral cultural line as the Paleo-Indian, was more or less contemporary with it, but possessed an ecological adaptation which was distinct from the big game hunters, and which ultimately generated the cultures of the Archaic Stage. Alternatively, it is equally possible the crude tools

may simply be quarry material, rough-outs or blanks intended for later processing or perhaps special purpose tools made by Archaic, Woodland or Mississippian period peoples. Their discovery in later contexts suggests this alternative as at least a partial explanation for the Lively Complex (DeJarnette 1967; DeJarnette, Walthall and Wimberly 1975a, 1975b).

The Paleo-Indian Period

In contrast to the preceding Early Lithic period, cultural complexes dating to the Paleo-Indian period are better represented in the southeastern archaeological record. The best known of these cultural complexes are characterized by the manufacture of large, thin lanceolate projectile points made on bifacially worked blade flakes. Generally, these lanceolate points exhibit a "flute" or channel flake scar at their bases which apparently represent a specialized means of hafting. The common association of beveled bone rods with Clovis fluted points has led Lahrens and Bonnichen (1974) to suggest that such fluting allowed the points to be attached to bone foreshafts, which in turn could be inserted into the socketed heads of lance shafts.

The most famous fluted point complexes, such as Llano, Clovis, Folsom, and the various Plano traditions, were first recognized and described in the western United States, and it is there that the most dramatic kill-sites have been located. Nevertheless, scholars such as Mason (1962:234) argue that since "fluted points of every description except Folsom are more numerous in the East, particularly in the southeastern United States, than they are in the Southwest or High Plains; and the area has produced the greatest diversification in fluted styles..." this abundance and diversification indicates that the fluted point complexes actually developed in the eastern United States. Supporting this contention is the association of a fluted point with a caribou bone fragment dated to 10,580 $\pm$ 370 B.C. from New York state (Funk et al. 1969). At present, this is the oldest dated example of such an artifact.

Whether the East or the Southeast is the place of origin for the fluted point complexes, the West is still the area in which they are best known. This is primarily because few kill-sites have been found in the East and none have been found in the Southeast. To date, most of the sites attributed to the Paleo-Indian period in the Southeast are either scattered surface finds or mixed, multicomponent sites which are difficult or impossible to unravel.

From northern Alabama and the adjacent portions of middle Tennessee, only seven Paleo-Indian period sites have been adequately reported: the LeCroy site (Lewis and Kneberg 1972), the Nuckolls site (Lewis and Kneberg 1958), the Wells site (Dragoo 1965, 1973), the Sims site (Adair 1976), the Quad site (Soday 1952, 1954; Wilmsen 1968), the Pine Tree site (Cambron 1956, 1958) and the Stone Pipe site (Cambron 1955). In addition, limited amounts of Paleo-Indian period lithics

have been recovered during the excavation of Archaic period layers at a number of other sites in the area and diagnostics are frequently found in a surface context (Walthall 1980:37-39; Clayton 1965; DeJarnette et al. 1962).

Data recovered from these and other sites in the Southeast generally suggest that the following cultural sequence is an adequate sub-division of the Paleo-Indian period given the present state of our knowledge:

Paleo-Indian period	12,000 B.C.	to 8000 B.C.
Eastern Clovis phase	12,000 B.C. (?)	to 9000 B.C.
Cumberland-Quad Beaver Lake phase	9000 B.C.	to 8000 B.C.

Clear, or at least unambiguous, evidence of human occupation in the Southeast apparently occurs near the end of the Pleistocene epoch with the appearance of the "Eastern Clovis" complex of the Paleo Indian tradition. This complex is typified by the thin, bifacially flaked, lanceolate Clovis point. These points, which range in length from 7.6 to 15 centimeters (3 to 6 inches), were "fluted" at the basal end by the removal of a flake. The bases of Clovis points often show signs of having been ground (Wilmsen 1968).

The Eastern Clovis phase in the project area is followed by what we have termed the "Cumberland-Quad-Beaver Lake" phase. This name is a hybrid of the Cumberland and Quad-Beaver Lake sequence distinguished by Walthall (1980:38-39). In this phase, the apparent technological homogeneity of the previous Clovis complex begins to break down. In the western United States, the smaller, fully-fluted Folsom point emerges, while in the Mid-South, such regional variants as the Cumberland, Beaver Lake and Quad point apparently replace the Clovis. Discussing this phase, Williams and Stoltman state that:

> The projectiles in the Southeast that apparently fall into the post-Clovis time period show considerable variation in shape, with only a general lanceolate form holding the group together. It is indeed tempting to set up a historical and genetic sequence of these forms with Redstone and Cumberland points, which are both fluted and unfluted, considered as later (Williams and Stoltman 1965:671).

The differentiation in the Paleo-Indian period of the earlier Clovis phase and the later Cumberland-Quad-Beaver Lake phase is based primarily on projectile point types rather than whole tool assemblages. This reliance on a single tool type is necessitated principally because northern Alabama, while seemingly rich in Paleo-Indian remains (Walthall 1980:47), lacks an extensive body of excavation data from deeply stratified sites with long and complete occupational

histories. Such data are required before a more well defined tool assemblage can be associated with either of the two phases. The need for determining the range of other artifacts associated with these phases is important not only in broadening our understanding of Paleo-Indian material culture, but also in providing more substantive and comparable data which can be used to delineate settlement and subsistence patterning.

Even though the excavation data on Paleo-Indian sites from our study area are scant, it is probably safe to refer much or all of the Clovis material found there to the time block between 12,000 B.C. and perhaps 9000 B.C., although Futato (1979) considers 10,000 B.C. to be perhaps a more appropriate ending date. Despite this rather fundamental disagreement, the termination of the subsequent Cumberland-Quad-Beaver Lake phase is generally agreed upon at 8000 B.C.

Virtually all of the Paleo-Indian sites reported from the region are surface finds, but the technical characteristics of their inventories closely approximate that recovered from "base camp" sites in the west. Dragoo (1973:47) notes that the lithic inventory includes items such as side scrapers, end scrapers, gravers, bifacial and unifacial knives, spokeshaves, flake scrapers, flake knives, end-and-side scrapers, cores, flakes, and hammerstones. Though found at "base camps" in the West, Dragoo states they are similar to assemblages in the East.

According to Wilmsen (1968:31-32), the Quad site located near Wheeler Lake in northern Alabama is one example of such a Paleo-Indian period base camp. He prefers to call such sites "multiple activity locations" as distinguished from "limited activity locations". This distinction is based primarily on the variety of tools represented and the ratio of finished tools to debitage. Artifacts at the Quad site:

> were found in small, highly concentrated clusters, generally widely separated. This concentration in relatively small areas suggests that the site was periodically occupied by small groups rather than by a large group at one time. The very low debitage: tool ratio (2:1) may be accounted for by assuming that very little stone working was carried on at the site. The scarcity of unfinished implements tends to support this assumption. Sampling error may contribute to this low ratio, but a very large increase in waste flake numbers would be required to alter it significantly. We may reasonably conclude that tools were imported in an essentially completed state, and that little stone working other than tool reconditioning was done on the site (Wilmsen 1968:31).

Nonetheless, the variety and range of Paleo-Indian tool types recovered from the site lead Wilmsen (1968) to conclude that multiple

activities including hunting, skin working, and wood and bone tool manufacture were carried on there. In this sense, the Quad site compared closely with the Lindenmeier site, a Paleo-Indian period multiple activity location from Colorado. However, he also noted that the collection from the Quad site contained three common tool characteristics which were extremely rare at Lindenmeier:

> The first of these is bifacial edge retouch, and the second is a tendency for tool width to reach a maximum near the proximal end of the specimen. The third is a tendency toward a higher frequency of "side-blow" flakes. These characteristics are common in later inventories associated with Archaic and Woodland culture...(Wilmsen 1968:32)

This contrast with the western Lindenmeier site coupled with the apparent continuation of these lithic trends into the later Archaic and Woodland period assemblages, led Wilmsen to postulate that plant processing within the rich forest-riverine environment was an important activity during the Paleo-Indian period as well as in later times (Wilmsen 1968:32).

If Wilmsen is correct in asserting that we can perceive differences in tool inventories between Paleo-Indian period sites on which multiple activities were performed and those on which only one or two kinds of activities took place, then it may be possible to reconstruct something of the Paleo-Indian "subsistence settlement system". That is, something of the spatial framework in which subsistence activities during the period were performed. Wilmsen's multiple versus limited activity sites could fit into either of two general kinds of settlement system: the homebase-satellite station model and the "macro-band - micro-band" model (MacNeish 1971; Judge and Dawson 1972).

Both types of sites would be expected in a system in which a home base was maintained for all or part of the year and special activities such as hunting or gathering were performed at satellite camps established temporarily at some distance from the base in proximity to the resources being exploited at the time. In this model, those task groups engaged in limited activities would return to the base camp to perform most of the "maintenance activities" such as tool production, hide working, and so forth.

A partial alternative to this homebase-satellite model would be a system in which a larger social group (what MacNeish 1971 has referred to a "macro-band") would break down and disperse into its minimal constituent parts (MacNeish's "micro-bands"). The schedule of agglomeration into the macro-band and dispersal into the various micro-bands would be closely timed to respond to variations in the seasonal abundance of key resources. In this model, perhaps what Wilmsen takes to be "multiple activity locations" are actually macro-band camps while his "limited activity locations" are micro-band camps. Actually, both models could be used to explain the occurrence of the two categories of sites recognized by Wilmsen.

Support for the homebase-satellite model is found in Judge and Dawson's work in the middle Rio Grande region of New Mexico (Dawson and Judge 1969; Judge and Dawson 1972). These scholars discovered that Paleo-Indian sites there are regularly found in very specific environmental settings in the vicinity of extinct Pleistocene ponds or "playas".

> ...these playas selected for occupation were generally situated near broad, open areas, which would have been suitable as rangeland for megafaunal populations...In each instance the dune ridge on which the site was found commanded an excellent view of both the playa and the hunting area (Judge and Dawson 1972).

This constellation of features, playa, overview, drainage and hunting area, no doubt reflects the emphasis on megafauna hunting which was apparently so characteristic of the Paleo-Indian period in western North America. Interestingly, Hubert's as yet unpublished site survey work in Colbert and Lauderdale Counties suggests that an association between Paleo-Indian period sites and a different, yet analagous, constellation of natural features is also present in northern Alabama. According to Futato (1979:12-14), Hubert's survey revealed that Paleo-Indian period sites tend to cluster in two settings, "high places near the back edge of the floodplain on the river, and high ground around the margins of sinks, presumably former lakes" (Futato 1979:13).

Futato (1979:14) interprets this pattern as representing "the exploitation of valley and upland environments somewhat moister than today". The sites clustering around these sinks or former lake beds are especially reminiscent of the playa concentrations observed by Judge and Dawson (1979). In addition, Walthall (1980:47) suggests that Paleo-Indian sites in northern Alabama are often found near "mountain passes and corridors" which presumably were on the seasonal migration route of large herd animals. Very likely these sites represent mastodon hunting camps. However, those sites located by Hubert on the high margins of the river valleys may have been situated so as to take advantage of other forest resources besides big game. If such was the case, these locations may be especially important to our understanding of the contrasts between cultural adaptations in the East and the West during the Paleo-Indian period. Such valley margin sites should thus be the particular target of any regional archaeological research design in northern Alabama.

The Archaic Stage: Climatological Change and Cultural Adaptation

Spaulding (1967:533) has characterized the Archaic stage in eastern North America as a "rather shaky classificatory union of a large number of small components scattered over practically the entire area under consideration". Basically this stage, like the roughly contemporaneous Mesolithic stage in the Old World, reflects the human

technical adaptation to the new and widely varying environmental conditions ushered in with the retreat of the final Pleistocene glaciation after about 8000 B.C. perhaps the four most important environmental changes from the standpoint of human culture at this time include:

1. The extinction, without replacement, of much of the Pleistocene megafauna, including the elephant, horse, and camel, and most of the bison species on which the Lithic Stage economy had been largely based (Martin and Wright 1967; Butzer 1971; Dreimanis 1968:257).

2. Certain fluctuations in rainfall and temperature as yet only partly understood but presumed to relate to worldwide climatic changes and to be generally correlated with glacial retreat and oscillations (cf., Antevs 1948; Martin et al. 1961; Denton and Karlen 1973; Denton and Porter 1967).

3. The plant and animal recolonization of the areas of North America which were previously glaciated, and the establishment of the modern geographical position of the major North American lifezones. The spruce dominated forests seem to have given way to pine dominated forests in the northern portions of eastern North America and to deciduous hardwood forests in the central and midsouthern parts. Pine-dominated forests came into dominance on the southern coastal plain (Hunt 1974:149-158; Butzer 1971; Cleland 1966:20-22; King and Allen 1977; Saucier 1977:42; Stoltman 1978:714; Whitehead 1965; Wright 1974:10-11, 1975).

4. The changing volume and gradient of the river systems draining eastern North America generated by worldwide deglaciation and rising sea levels (Bloom 1971; Emery and Edwards 1966).

These changes have been generally regarded as signaling the demise of the Paleo-Indian big game hunting tradition. However, as we have pointed out above, this traditional view of Paleo-Indian subsistence, formulated on data from the West and Southwest, may not be wholly applicable to the Southeast. Consequently, we cannot be certain as to the degree to which environmental changes and the extinction of megafauna significantly altered the Paleo-Indian economy and ushered in a more sedentary Archaic settlement pattern with heavy reliance on gathering.

It does appear that the Archaic period was characterized by localized or regionalized stone tool traditions which may be a reflection of specific adaptations to different local environmental conditions. Even assuming that new environmental conditions stimulated regional adaptive responses, the shifts were not to an entirely new economic base. Rather, hunting seems to have been directed toward different, smaller and more varied game, while over time, gathering of plant and such hitherto-neglected animal species as shellfish became increasingly more important.

These shifts may be best represented by the Dalton Culture that is variously placed in the very late Paleo-Indian or very Early Archaic period. Represented by the Dalton projectile point, this culture is viewed by Morse (1973) as basically a Paleo-Indian assemblage, while Walthall (1980) places it as the earliest phase of the Early Archaic period.

At the Stanfield-Worley Rockshelter in Alabama, a major Dalton component was found in the basal level, Zone D, which was a sealed cultural level containing a Dalton occupation and a later Big Sandy occupation (Walthall 1980:63). Whether the presence of these two components in Zone D represents a clear Lithic-to-Archaic transition or early and later Early Archaic occupations is still somewhat debatable. Radiocarbon dates average out to about 7300 B.C., a good early Archaic date; but Walthall (1980:63) suggests the Dalton assemblage probably dates nearer to about 7700 B.C. and maybe even two or three centuries earlier.

An increasing body of data from Alabama has led Walthall (1980:64) to suggest that the open-air and rockshelter campsites yielding Dalton points in the Tennessee Valley represent components of a seasonal economic cycle that also, as Williams and Stoltman (1965) noted, included a trend toward a riverine-oriented economy. Duration, size, and permanency of occupation seem to be the only criteria separating the two models. But the important point is that the Dalton culture, whether associated with the terminal Paleo-Indian or earliest Archaic manifestation does seem to underscore settlement and subsistence changes that strongly characterize the Archaic stage in the southeastern United States.

The Early Archaic Period

Although Willey (1966:252) defines the Early Archaic period as falling between 8000 and 5000 B.C. in eastern North America, we have chosen to follow Griffin (1978:58) and date the close of the Early Archaic period 1000 years earlier at 6000 B.C. Certainly the presence of milling stones in the earliest levels at Graham Cave, Missouri (Logan 1952; Klippel 1971), the distinctive Archaic notched points in the 8000 B.C. to 6000 B.C. Zone I occupation at the Modoc Rock Shelter in Illinois (Fowler 1959:258-262), the post-7000 B.C. Layer G at Russell Cave (Griffin 1974:14) and Zone C at the Stanfield-Worley Rockshelter dated to sometime between 8000 and 7000 B.C. in northern Alabama (DeJarnette, Kurjack and Cambron 1962), the Kirk horizon at Icehouse Bottom and a number of other sites in the Lower Little Tennessee River valley in eastern Tennessee (Chapman 1975a, 1977), the basal level at the St. Albans site in West Virginia (Broyles 1966:41), and, most recently, the Early Archaic period levels at Meadowcroft Rock Shelter in Pennsylvania (Adovasio et al. 1978:643) all suggest that the Archaic cultural tradition was beginning to be established over a wide area of the East and Southeast at the end of the Pleistocene epoch.

Although the early material from these and other sites clearly indicate that some kind of cultural, and presumably economic, transformation was occurring in this part of North America after about 8000 B.C., we cannot be certain whether the Archaic tradition evolved directly out of the preceding Paleo-Indian tradition or emerged independently from some as yet unidentified hunting and gathering tradition with separate ancient roots in the Pleistocene. In support of this latter interpretation, there is some suggestion that Paleo-Indian and Archaic peoples coexisted for a while in the early Post-Pleistocene at the Nuckolls site in Tennessee (Lewis and Kneberg 1958:64), and in western Kentucky (Rolingson and Schwartz 1966). The key sites, however, listed earlier show no evidence of such temporal overlap and on the basis of what he refers to as "continuities identified or asserted by various authors" (Griffin 1978:57:58) at such stratified sites as Graham Cave, Griffin categorically asserts that the cultural assemblages of the Early Archaic period gradually evolved out of the preceding Paleo-Indian tradition. Walthall (1980:56) suggests that this developmental sequence is particularly clear in northern Alabama at the sites of Russell Cave and the Stanfield-Worley Rockshelter.

In addition to citing these examples of the apparent stratigraphic continuity between the two traditions, one might further support Griffin's view that Paleo-Indian is the ancestor of the Archaic on typological grounds. For example, the "Dalton" projectile point type reported from the Mid-South between 8000 and 7000 B.C. (Morse 1973) is at least the formal equivalent of the "Meserve" point characteristic of the late Paleo-Indian Plano complex farther west (Forbis 1975:76). In turn, the Dalton point seems to reflect a formal transition between the lanceolate-shaped Paleo-Indian types such as Clovis and Cumberland, and the squat shapes with more elaborate, generally bifurcated hafting (i.e. projectile point types as Kirk, LeCroy, and Stanley). The squat shape and bifurcated hafting area which characterize these latter types are becoming recognized as horizon markers for the Early Archaic period over a wide area of the Eastern United States in general (Fitting 1964; Dragoo 1976:11) and the Southeast in particular (Chapman 1975a, 1977; Futato 1977:232).

In addition to the projectile point types, the technological repertoire of Early Archaic period cultures is generally characterized by:

> both hand and slab stones for grinding; hammerstones; large ovoid to triangular blades; scrapers; flint drills with expanded or cylindrical bases; blades; gravers; chipped stone adzes or gouges; chipped grubbing tools or hoes; and pebble pendants. Very few bone awls or other tools have been recovered (Griffin 1978:58).

The ground-and-polished tools, which were originally considered to characterize the Archaic tradition as a whole by Willey and Philips (1955:740) are apparently not present until sometime after 6000 or

5000 B.C. (Stoltman 1978:715) and are thus important horizon markers for phases dating to the Middle and Late Archaic periods. However, flaked stone tool types, such as the "Dalton adze" described by Morse (1973) are likely Early Archaic prototypes for the later ground-and-polished versions of those tool forms. The general scarcity of tools associated with plant food preparation and with fishing in these early assemblages "indicates that these activities were minor in comparison with hunting" (Dragoo 1976:11). Dragoo (1976) also suggests that the small, scattered Early Archaic period sites with their limited remains reflect both hunting emphasis and a correspondingly low population density (also cf., Stoltman 1978:714; Griffin 1967, 1978:58). Thus, whatever the specific ancestry of Archaic cultural traditions, Dragoo and numerous other scholars conclude that Early Archaic period subsistence systems continued the migratory hunting and gathering patterns of the Pleistocene into environments gradually becoming more like those of the present. However, a caveat is perhaps in order here. Deep trench testing and excavation in the Telico Reservoir in eastern Tennessee have revealed Early Archaic period occupations in hitherto unsuspected numbers and densities (Chapman 1977). In light of these findings, we must consider the possibility that these early populations appear small, isolated and peripatetic only because the actual extent of their settlement in the Southeast has been obscured by the depth of the alluvial overburden which has accumulated in the river valleys they once occupied.

Summarizing the archaeological data bearing on subsistence between 8000 B.C. and 6000 B.C., Stoltman (1978:714) concludes:

> the white-tailed deer had become the principal game animal hunted throughout the East, supplemented by a variety of smaller game, including rabbit, raccoon, opossum, squirrel, beaver, muskrat, and turkey (e.g., Parmalee 1962; Fowler 1959:61-65; Chapman 1975a:107; Griffin 1974:81-90). Fish, shellfish, and plant foods were surely also gathered but presumably were decidedly secondary food sources, for the archaeological evidence of their utilization is extremely meager.

Stoltman (1978:714) goes on to conclude that subsistence systems in the Southeast move toward increasing dependence upon such gathered foodstuff as plants and shellfish during this time making cultures of this period "appear to be truly transitional between the more specialized hunting pattern of the Paleo-Indian era and the more sedentary gatherer-hunter pattern" of the subsequent Middle Archaic period. Perhaps we should note that Morse (1978) and others strongly demur and suggest that we really have insufficient evidence to allow us to judge the relative importance of gathering during either the Paleo-Indian or Early Archaic periods.

Regardless of one's assessment in the "state-of-the-art", in determining subsistence patterning in the Early Archaic period, it is

clear that a better understanding of this issue will continue to emerge as the data base broadens. In this regard, archaeological research in northern Alabama, such as that represented by this project, may play a significant role since two of the most important Early Archaic period sites in the Southeast are located in Northern Alabama: Russell Cave and the Stanfield-Worley Rockshelter. Both of these sites have been intensively excavated in recent years, and in sharp contrast to so many important southeastern sites, have been reported in print.

In light of these facts, it is perhaps ungenerous to note that the stratigraphic delineations within their deposits were rather gross. Russell Cave has perhaps suffered the greatest harm in this respect. Initial discovery and excavation of the cave was carried out by a number of local amateurs who leased the site for that purpose in the early 1950s. Fortunately, their work was reported by Bettye Broyles (1958), a professional archaeologist. Subsequent excavations undertaken for the National Geographic Society by Miller (1958) have never been fully reported but a third and final field campaign by John W. Griffin after the site was acquired by the U. S. National Park Service resulted in an adequate, albeit very brief, professional report (Griffin 1974). Following previous investigators in the cave, Griffin (1974:8-9) distinguished only seven stratigraphic "layers or units" in the 32 feet of cave fill between the present surface of the cave and its bedrock floor. The lowest stratigraphic unit, Layer G, was assigned to the Early Archaic period on the basis of five C-14 dates which ranged from 6550 ± 320 B.C. to 5615 ± 250 B.C. (Griffin 1974), the earliest of which was obtained from an infant burial. Layer G consisted of a rather complex interbedded mixture of ash and charcoal, presumably from human campsites, and sediments of natural origin (Griffin 1974:25). This layer yielded 84 projectile points from its upper and lower sections. No Paleo-Indian points were present and only one Dalton point may have been associated with the layer (Griffin 1974:41). Instead, Layer G produced a wide range of projectile points recognized in other contexts as Archaic types. These types included: Stanley, Crawford, Kirk Serrated, Pine Tree, Elk River, and Russell Cave. Griffin (1974:44) observed that stemmed forms generally came to replace the expanded stem and side-notched forms from the bottom to the top of Layer G.

Taken together, the large number of projectile points and the paucity of other cultural remains suggests that Layer G represents the occasional utilization of Russell Cave as a temporary hunting station by small groups of Early Archaic period wanderers. The faunal remains recovered from the layers indicate that a fairly wide range of modern species (and at least one example of an extinct form of peccary) were being taken by the Early Archaic period occupants of the cave (Griffin 1974:105-107). A major problem with interpreting Early Archaic occupation on the basis of Russell Cave data is the presence of a number of Morrow Mountain and Kays points that were also found in Layer G. Represented by both the standard base and rounded base, Morrow Mountain points are chronologically associated with the Middle rather

than the Early Archaic, and Kays have a Middle to Late Archaic range. The gross stratigraphic delineations mentioned above may have resulted in a failure to separate well the Early Archaic markers from later diagnostics.

Occupation at the Stanfield-Worley Rockshelter seems to have predated the accumulations of Layer G at Russell Cave. Here, deposits have been divided into four stratigraphic units: A, B, C, and D. Zone D, the earliest of these units at the shelter, produced C-14 dates of 7690 ± 450 B.C. and 6970 ± 400 B.C. (DeJarnette, Kurjack, and Cambron 1962). As discussed previously, at least two distinct components were present in this layer: a Dalton occupation and a Big Sandy occupation (Walthall 1980:63-64).

As at Russell Cave, the predominance of projectile points and hide working tools in the lithic repertoire, combined with the apparent absence of plant processing tools, suggests that the site was utilized chiefly as a hunting station. Parmalee's (1962) analysis of the faunal remains from Layer D indicates that white-tailed deer was the main prey sought by these hunters, along with a number of smaller mammals common in the region today, such as squirrel, raccoon, and turkey. The importance of plants in the diet at the beginning of the Early Archaic period cannot be ascertained from the data recovered at Stanfield-Worley.

In his recent synthesis of Alabama prehistory, Walthall (1980:58-75) divides the Early Archaic period in northern Alabama and the Middle Tennessee Valley region into three phases (Red Hill, New Garden, and Doran) which are expressed in four horizons (Dalton, Big Sandy, Kirk, and Bifurcate Points). It strikes us, as it did Futato (1979:14-15), that at this stage of our knowledge, such a division is premature. This is especially eivdent when we note that Walthall (1980:59) recognizes only one phase each for each of the following Middle and Late Archaic periods, despite the fact that the cultures of these later time blocks are far more clearly defined and understood than those of the Early Archaic period. It is also important to note that Walthall's phase and horizon system relies heavily on the early layers at Russell Cave and Stanfield-Worley. Both these layers were more than a meter (3.28 feet) thick in some places and were excavated as single stratigraphic units. It seems unsound to recognize multiple horizons within these layers when such horizons can only be segregated by reference to projectile point morphology or type rather than physical stratigraphic association and superposition. Further, the temporal spans of many of these projectile point types are not entirely reliable since they have been dated only by reference to similar forms excavated in controlled contexts in other parts of the East and Southeast and have been reported mainly from surface collections in northern Alabama. Even most of the type sites whose names Walthall uses in his system have been surface-collected but never excavated. Although we applaud Walthall's effort, we feel that it is more prudent to regard his system as a tentative reconstruction of Early Archaic period prehistory. It is suggested, however, that a detailed

delineation of the Early Archaic period remains one of the critical problems of northern Alabama archaeology. Thus, the discovery and careful excavation of a deeply stratified cave or rockshelter site in the region should be a primary research aim of any site survey and excavation program conducted there.

The Middle Archaic Period

Following Griffin (1978:59), we have termed the years between 6000 and 4000 B.C. the Middle Archaic period. Culturally, the Middle Archaic is distinguished by the emergence of a variety of new artifact types and craft media. According to Griffin, the period

> can be recognized in the appearance of such forms as grooved axes, stone pendants, and early bannerstone forms, and such grinding and pounding tools as the bell pestle. A well developed bone industry of awls, projectile points, flakers, and atlatl hooks is assigned to the Morrow Mountain Complex at the Stanfield-Worley Shelter in northern Alabama...A bone industry is also recognized in the Eva Complex of west Tennessee...and the first dog burials also appear at this time (Griffin 1978:59).

The quality of the workmanship exhibited by many of these artifacts indicates an increasing improvement in stone-grinding and polishing as well as bone-working technologies. The appearance of new forms in the tool assemblages at this time presumably represents either the development of added economic or subsistence activities or the refinement of existing ones. The dog burials, considered as a symbol of the emerging, or perhaps intensifying, symbiosis between man and that species, are also not without their economic implications. After all, few partnerships are as mutually beneficial as that struck between the hunter and his dog. Perhaps another barometer of increasing subsistence efficiency is the common appearance of human burials. These burials, which are generally flexed and accompanied by grave goods, may indicate a less peripatetic existence. Since many of these grave goods are made of exotic or non-local materials, one can assume that trade and the production of some "surplus" is also a feature of Middle Archaic period life (Winters 1968). Much of this hypothesized increase in settlement stability and surplus productivity is perhaps based on the increasing importance of shellfish and other aquatic resources near the end of the period.

Finally, a number of scholars conclude that the Middle Archaic period is characterized by larger populations than the preceding period. Generally, this conclusion is based on the apparent increase in the numbers of components assignable to this period and to the apparent increase in the average size of sites at this time. Somewhat more tenous evidence of this trend is offered by Walthall (1980:65-66) who suggests that the apparent increase in the raw numbers of projectile points from the Early through the Middle Archaic periods in the

Tennessee Valley may be taken as evidence of population increase or the intensification of hunting in that area. Of course, this apparent population increase has also often been interpreted as a result of the greater emphasis on shellfish and other aquatic resources in a similar sense as these subsistence items may have affected settlement stability and surplus production. Reviewing the evidence of human diet in eastern North America from the years between 6000 and 3000 B.C., Stoltman concludes that the

> most significant process was the transformation of subsistence economies focused primarily upon deer and small-game hunting into economies with a more equal balance between hunting and the gathering of plants and/or aquatic foods (1978:715).

Stoltman emphasizes that this trend is not toward an increased diversity in the food species exploited but rather a decline in the importance of hunting relative to other gathering.

The innovation, increasing cultural complexity, dietary change, and apparent population growth visible in the archaeological record of the Middle (and Late) Archaic periods led Caldwell (1958) to formulate one of the most useful interpretative notions developed for the Archaic stage, the concept of "primary forest efficiency". According to Caldwell, eastern North American prehistory has an essential unity about it. This unity results from the absence of any impenetrable geographical barriers to human interaction within the region and to the fact that prehistoric cultures there all experienced three major developmental trends of processes over time. The latter two of these, the "dominance of regional differentiation and stylistic change", and the "increasing connections with Nuclear American civilization" (Caldwell 1958:71), will concern us later. The earliest of these three areal trends was the

> increasing efficiency in exploiting the forest, manifested in the development of ambush hunting, seasonal cycles, and the discovery of new sources of natural foods. This trend was progressive in the sense of being an increasingly successful adjustment to the eastern forest environment. It seems to have culminated in Late Archaic times, at the beginning of the second millennium B.C., in what we have called the establishment of primary forest efficiency. As a result, peoples in the areas of more abundant food resources achieved a degree of residential stability (Caldwell 1958:vii).

Archaeological support for Caldwell's (1958) primary forest efficiency model has been obtained from at least two major sources: 1) the paleo-botanical research being carried out at the Koster site in Illinois, and 2) the emergence of the "Shell Mound Archaic" tradition in the Southeast sometime after about 4000 B.C. At Koster, the

application of careful screening and flotation and other techniques to the fill sediments at the deeply stratified site has led to the most complete picture to date of Archaic period subsistence. Asch, Ford, and Asch (1972) conclude that the Archaic peoples on the lower Illinois river exploited a broad spectrum of wild resources, especially nuts from a variety of tree species with increasing intensity through time, and that this intensification lead to population growth and greater sedentism. However, at Koster, this intensification apparently began to approach its maximum efficiency at around 5000 B.C., substantially earlier than Caldwell had supposed was the case (Jennings 1968:131-132).

South of Koster in the drainages of the Ohio, Cumberland, Tennessee, and other major river systems of the Southeast, impressive earth and shell midden sites associated with the manufacture of high-quality, often elaborate artifacts and large numbers of burials appeared shortly before 4000 B.C. As noted above, the emergence of this impressive horizon, particularly in northern Alabama and middle Tennessee, is generally taken as evidence of a new subsistence orientation focused on the freshwater shellfish which became abundant only with the creation of shallow slow-moving rivers following the rising sea level in the middle Holocene. However, as Caldwell (1958:12) notes, shellmound sites seem to be found in areas where deer and wild nuts were available suggesting that only a mixed economy which intensively exploited other resources could have supported the large and presumably semisedentary populations represented at such sites as Indian Knoll (Webb 1946). Parmalee and Klippel's (1974) nutritional study of freshwater shellfish further confirmed this point of view by demonstrating first that shellfish were by no means a complete food from the standpoint of human nutrition, and second that they were markedly lower in protein than other locally available resources such as wild turkey, deer, and raccoon meat. Although as Winters (1974:ix-x) points out, shellfish may have provided essential vitamins, trace elements, or other nutrients missing in venison, it seems apparent that we can no longer interpret the appearance of high population densities and cultural complexity of the Late Archaic shellmound peoples as simply the by-product of the nutritional richness of the shellfish. Instead, the mussel seems to have become the focus of Late Archaic period subsistence because of its other advantages: viz., the predictability of its location and the ease of its procurement. Mussel shell collection is precisely the kind of activity that can be profitably given over to children, pregnant women, and old people who form the least mobile segment of any population. It is probable that given a choice, shellmound Archaic peoples would generally opt for the meat of deer, wild turkey, raccoon, opossum, or some other terrestrial mammal over the gritty and somewhat bland flesh of the freshwater mussel. But, no matter how rich the environment, such choice is not always available. Like the mongongo nuts gathered by women and children among the !Kung Bushmen (Lee 1969, 1972) while the men are out big game hunting, mussels would have been the kind of food which could be eaten as a supplement when the hunt was successful and as the entire meal when it was not.

In sum, while other resources would have provided greater caloric and nutritional value, the systematic procurement of such resources would probably have demanded more risk, greater group mobility, and probably smaller group size. By the end of the Middle Archaic period, peoples living along the great river systems of the region seem to have adopted a "satisfying" rather than "maximizing" subsistence strategy. That is, they seem to have been willing to accept somewhat lower food return in exchange for lower procurement risks and greater residential stability. However, it appears that population growth is also related to the degree of sedentism worldwide and that population increase may have been the more-or-less unwitting consequence of the Middle Archaic period people's attempt to reduce their mobility.

The changes that may have occurred during the Middle Archaic to precipitate a reduction in mobility and changes in subsistence patterning most apparent at the end of the period are by no means well understood. Clarification of the archaeological record requires the input of other sciences such as the accumulation of Holocene climatological data. These data require additional data on variation in hydrology and floral and faunal resources. Such an interdisciplinary approach is being undertaken on a monumental scope in the Early Man projects of the Tombigbee Waterway in Alabama and the Richard B. Russell Reservoir along the Savannah River. Both projects, when completed, will contribute valuable information from which future archaeological interpretations can be drawn on a regional scale. Until that time, however, an understanding of changes during the Middle Archaic has to rely on stratigraphic excavation, variations in the artifactual assemblages, and specialized analyses usually conducted on remains and samples from a single site.

In northern Alabama, the earliest dated Middle Archaic period component presently known comes from the bottom layer of the Stucks Bluff Rock Shelter on the Luttahatchee River in Lamar County (DeJarnette, Walthall, and Wimberly 1975b). This component returned a C-14 date of 4500 + 120 B.C., which suggests that the site was utilized at a time roughly contemporaneous with or slightly earlier than the occupation of Layer F at Russell Cave where three C-14 dates cluster tightly between 4360 $\pm$ 140 B.C. and 4030 $\pm$ 200 B.C. (Griffin 1974:14). However, a huge gap separates the C-14 dates from these two Middle Archaic components and the latest date for the Early Archaic, which was 6000 B.C. based on C-14 samples from upper level 6 at Russell Cave.

According to Futato (1979:16), cultural horizons which should date to the years between about 6000 B.C. and 4500 B.C. in the Middle Tennessee Valley include "the late bifurcates, Stanley, Kirk Stemmed, and Eva. However, Walthall (1980:78) defines a local phase for the entire Middle Archaic period in northern Alabama which he calls Sanderson Cove. Walthall considers the late Middle Archaic Morrow Mountain point to be the horizon marker for this phase and justifies his selection on the grounds that such a point type and its variants form the horizon markers for similar phases in the Carolina and Georgia Piedmont region and elsewhere.

In order to lump the entire Middle Archaic period into a single phase, however, Walthall is forced to downgrade the possible stylistic relationship between the Morrow Mountain point types and the ancestral forms of the Eva point type recognized by Long and Josselyn (1965) and to disregard the fact that Morrow Mountain points are found stratigraphically above (and therefore later than) the Eva points at the Eva site in West Tennessee (Lewis and Kneberg 1959). Since Eva points and related materials are known from northern Alabama (albeit mainly from surface collections), it seems likely that as we come to understand the prehistory of northern Alabama in greater detail, we will be forced to define an early Middle Archaic period Eva-like phase prior to Walthall's Sanderson Cove.

In the Middle Tennessee, the Eva phase was first defined by Lewis and Kneberg (1959) based on their work on the earliest components at the Eva site (Lewis and Lewis 1961) and the Big Sandy site. The phase is considered to begin sometime before 5000 B.C. According to Lewis and Kneberg (1959:21),

> the Eva settlements were small; each included a habitation area and a single large trash heap which also served a cemetery. The trash heaps were mainly composed of discarded clam shells, whenever the settlements were located near clam beds. Other garbage and the general refuse were also assigned to the same heaps, which, through the centuries, grew into large mounds that covered hundreds of square feet (1959:21).

Ground stone artifacts, such as spearthrowers or atlatl weights, are common in components of this phase, together with bone awls, pendants as well as projectile points, including the characteristic basal-notched Eva point, straight-stemmed points, and a few side-notched examples. Mortuary customs included the interment of fully-flexed bodies in circular pits (Lewis and Kneberg 1959:163). The Eva phase apparently lasted until 3500 B.C.

The Eva phase is most closely approximated in northern Alabama in the earliest component at the Mulberry Creek shellmound site. The complex interbedding of sediment, shells, and cultural material suggests that this site was repeatedly reoccupied during the course of countless seasonally-scheduled subsistence rounds in which availability of the freshwater mussel played a significant role. Although presently subsumed under the Walthall's Sanderson Cove phase, the Middle Archaic component such as that at Mulberry Creek may better represent a northern Alabama Eva-like phase we alluded to above. The question is, however, a moot point until more excavation data are available. Regardless of the ultimate resolution, Middle Archaic occupations like Mulberry Creek are important in understanding differences during the period.

The Mulberry Creek site is also significant in the fact that a large number of human burials dating to the Middle Archaic period were

recovered there. A number of these burials showed evidence of traumatic injury and violent death (Webb and DeJarnette 1942), perhaps suggesting that the growing populations of the Middle Archaic period were beginning to tax local resources and thus engender intergroup or interpersonal competition and strife.

But aside from this rather ominous note, the Middle Archaic period in northern Alabama seems to have been characterized by cultural growth and technical enrichment. In a list of the new traits which entered the cultural repertoire in the area at this time, Walthall (1980:87) includes

> the atlatl with antler hooks and ground stone weights, flexed round grave burials often accompanied by utilitarian grave goods, a variety of bone tools, antler-tip projectile points, turtle cups or rattles, and perhaps specialized grinding stones such as the bell pestle.

The stage apparently was set for the development of the Archaic tradition in northern Alabama and the Mid-South to its highest levels of population, subsistence efficiency, and cultural elaboration in the so-called "Shell Mound Archaic" cultures in the following period.

The Late Archaic Period

The Late Archaic period is here dated to between 4000 and 500 B.C. There is some evidence that this time block was characterized by long-term, worldwide climatic oscillations. As has already been pointed out (Chapter 6), the relationship between climate in the southeastern United States and these alternating worldwide cycles of glacial advance and retreat is far from clear. Although the relationship may not have been a simple linear one, we suspect that these cycles affected temperature and rainfall in the Southeast in a pronounced fashion. Further, it has been suggested by a number of scholars (Haag 1962; Dragoo 1976) that this rising sea level had a profound effect on the gradients of the rivers draining the continent. This higher sea level and lower gradient meant that the rivers were forced to slow down and meander more expansively across their floodplains. Such conditions would have increased the areas of shallow, slow-moving water and thus expand the habitats of a variety of freshwater mussel or shellfish species. In a similar fashion, Turnbaugh (1975) has suggested that the rising sea level, combined with the ameliorating temperatures following after about 2000 B.C., had an impact on the habits and northward distribution of anadromous fish like the shad and the alewife. These fish characteristically seasonally migrate into the rivers which spill into the Atlantic on the eastern seaboard; the new climatic conditions meant that they would have been available earlier or in greater number than previously. The greater availability of these species apparently set off a rapid northward population expansion of Late Archaic period "Broadpoint" peoples on the eastern coastal plain.

We have already discussed the apparent increase in shellfish exploitation in the Southeast around the end of the Middle Archaic period. The increased use of this and other aquatic resources there signals to Winters (1974:x) that specialized, relatively narrow-spectrum subsistence systems which he refers to as "harvesting economies" had begun to emerge. In the Midwest and Southeast, such economies would have been

> based upon a few essential resources, which in this case would have been deer, mussels, and nuts---a triumvirate that has the admirable quality of supplying all known essential nutrients, with the exception of an adequate supply of vitamin C (Winters 1974:x).

These Late Archaic period riverine harvesting economies seem to have been capable of generating food surpluses sufficient to support large and fairly stable populations. Very likely, they were also able to reduce their seasonally scheduled movements to perhaps only one or two per year. Evidence for this surplus is seen in the size of their shell and earth midden sites, the number of burials found within these middens and the elaborate mortuary furnishings recovered with the burials. Sites like Indian Knoll and Carlston Annis in Kentucky and the Robinson Shellmound in Tennessee contain prime examples of this kind of evidence. Surplus of some form is also reflected in many of these grave furnishings having been fashioned from raw materials which were not available locally. This period

> witnessed the first systematic long-distance trade in exotic materials. Gulf and Atlantic Coast shells, Great Lakes copper, Appalachian slate and steatite, Ozark hematite and magnetite, and Harrison County (Indiana) chert are some of the materials that appear in the archaeological record in notable amounts for the first time beyond the immediate confines of their source areas (Stoltman 1978:717).

Significantly, this rich and stable "harvesting" economic setting apparently also sees the appearance of the first ceramics in North America sometime between 3000 and 2000 B.C. on the St. John's River in Florida and the Savannah River in South Carolina (Sears 1964:261; Bullen and Stoltman 1972; Stoltman 1974). The gradual inland spread of fiber-tempered ceramics appears to have taken place sometime after 2000 B.C. up the Savannah River to northern Alabama and middle and western Tennessee via the Tennessee River. Peterson reports a date of 1370 ± 160 B.C. for a fiber-tempered ceramic horizon in western Tennessee. Fiber-tempered ceramic assemblages are characterized by primitive molded vessels which are often flat-bottomed or pan-shaped. The paste of which these vessels were made was tempered with grass or even whole leaves. This ceramic tradition appears abruptly within Late Archaic period cultural repertoires which otherwise seem undistinguished so that the derivation of the tradition in uncertain. On

one hand, it might be the result of waterborne contact with coastal South America via the Antilles; on the other, that it was a local southeastern development originating within or inspired by the tradition of groundstone bowl manufacture which begins somewhat earlier in the Southeast. In any event, it is generally assumed that to use and manufacture pottery, a group must be fairly sedentary. If this is the case, then, by the Late Archaic period, certain peoples in the Southeast had apparently developed their subsistence bases to a level sufficiently productive to allow them essentially to remain in one place throughout most of the year. Since it appears that fiber-tempered pottery occurs most frequently on shellmound sites, Caldwell (1972:367) suggests that shellfish collecting provided the most stable economy during the Archaic.

The Late Archaic period in northern Alabama has been divided into two sequential phases: the Lauderdale and the Bluff Creek. The Lauderdale phase represents the classic expression of the so-called "Shell Mound Archaic tradition" in the Mid-South. It was first defined as a "focus" by Webb and DeJarnette (1942, 1948b) and only later referred to as a chronological phase by Lewis and Kneberg (1959). Walthall (1980:91) prefers the phrase "Lauderdale culture" on the grounds that

> the long temporal span and internal diversity represented within these shell mounds indicates that upon future research these occupations will be subdivided into a number of discrete classificatory units probably based upon changes in projectile point themes.

Although Walthall is probably right in predicting that the Lauderdale phase is destined to be subdivided into smaller units in the future, until that time we prefer to retain the phase designation in order to be consistent with previous usage.

The clearest evidence of the Lauderdale phase is found in the large shellmound sites adjacent to expansive mussel shoals along the western Middle Tennessee River in northwestern Alabama. That these mussel shoals were immensely productive and reliable resource localities is attested to by the size of the mounds themselves, some are more than three meters (9.8 feet) in height. These mound sites consist of mussel shells, earth, organic, and cultural debris and human remains which apparently accumulated as the by-product of countless seasonally-scheduled subsistence rounds. According to Jenkins (1974:186-187), such shellmound sites were probably occupied from the early spring to the early fall, that is, from about May to October. As noted in the preceding section, while it is unlikely that shellfish were the sole source of subsistence during the Late Archaic period, such species probably formed the stable base around which hunting and gathering activities directed at less reliable, less continuously available, or less easily collected species could be arranged.

During the late fall and winter, the increased seasonal rainfall in northern Alabama and the Mid-South generally raises the levels of the rivers there. Since these high river levels would have rendered the mussel shoals inaccessible, or at least less accessible, Jenkins (1974) concludes that the Lauderdale-phase peoples would have left the river valleys and exploited upland resources such as nuts and wild game from about November until April. One such upland site dating to about 1650 + 180 B.C. was excavated on Little Bear Creek by Oakley and Futato (1975). This site, 1Fr524, appears to have been primarily a nutting station as it contained numerous large storage pits which were full of hickory nut shells. These shells would probably have been collected during the late fall and then gradually consumed over the course of the winter. Nut production from year to year was probably variable and the numbers of nuts which could be collected and stored would have been a function of the size of the social unit engaged in the collection. Unlike shellfish, which are presumably available all season long, the nut harvest would occur within a limited period of the year. Therefore, the early fall was probably a critical period in the Lauderdale phase subsistence round, since a group failing to put by enough nuts would probably be unable to survive the winter intact. Even with a large supply of stored nuts, the months of March and April were probably hard ones for Lauderdale phase peoples. By the early spring, it is likely that the stored nut resources had begun to be exhausted and the countless edible shoots, plants, and roots of the early spring would not yet have been available. These months probably constituted the "starvation season" among the Lauderdale peoples. And, since this would have been the season of minimum availability of food, it would have been the period in the annual cycle which would place the ultimate limit on the size of the human population which the local subsistence system could support.

In addition to subsistence data, Lauderdale phase sites have provided us with a vivid picture of the material culture of the Late Archaic period peoples in northern Alabama. In this regard, the burials recovered by Webb (1946) and Webb and DeJarnette (1942) have been especially fruitful. Lauderdale peoples customarily interred their dead with grave goods, presumably personal possessions, and these grave goods have provided us with a glimpse both of their technology and of the nature of their sexual division of labor and nascent status system. Further, Webb and DeJarnette's (1942) excavation of various Lauderdale phase graves provided the first definite evidence that the atlatl or spearthrower was used in the Southeast during the Archaic period. Despite the fact that the wooden parts had decayed away, the linear alignments of bone atlatl hooks, projectile points, and bannerstones in association with male burials led Webb and DeJarnette (1942) to conclude that these three classes of artifacts were all part of the atlatl complex and were used together. The interpretation of groundstone bannerstones as atlatl weights rests in large measure on Webb's interpretation of these alignments. However, as Dickson (n.d.) notes in a recent review of atlatl studies, these interpretations may no longer be entirely tenable.

Lauderdale phase sites have also produced a wide range of other kinds of artifacts including jewelry of shell, bone and antler, bone and antler tools such as awls and needles, stone plummets, and gorgets, to name just a few. Perhaps most significantly, vessels of steatite and sandstone have been recovered from sites dating to the end of the phase. These heavy containers have generally been interpreted as reflecting increasing sedentism at least by the end of the Late Archaic period. Certainly the bulky nature of these stone vessels suggest that they were not made to be carried about during a lengthy Volkswanderung. However, such vessels cannot be taken as prima facie evidence of full-time sedentism since they could easily have been cached in the fall for subsequent reuse in the same location during the following spring and summer.

However, such groundstone items as these containers, together with the characteristic bell-shaped Lauderdale phase stone pestles and other groundstone tools, indicate a greater willingness on the part of Late Archaic period peoples in northern Alabama to expend energy in a kind of "long-term capital investment" rather than relying on more quickly made (and less durable) kinds of tools.

The final cultural event of the Late Archaic period in northern Alabama is the appearance of Wheeler series fiber-tempered pottery. As noted in the preceding section, this ceramic tradition apparently emerged first on the Atlantic coastal plain and was concentrated on the shell midden clusters near where great rivers such as the Savannah and the St. John's flow into the sea. While ceramic manufacture began in these coastal or estuarial settings as early as 2500 B.C., fiber-tempered ceramics did not reach northern Alabama until 1000 or 1500 years later, apparently as a result of slow diffusion upstream along the Tombigbee River drainage (Jenkins 1975; Futato 1979:19). Radiocarbon determinations suggest a date of around 1370 ± 160 B.C. for fiber-tempered ware in Mississippi (Peterson 1973:35); presumably such pottery is slightly older in northern Alabama.

Wheeler series ceramics are the hallmark of the Bluff Creek phase (Walthall and Jenkins 1976; Futato 1979:19). This phase has been dated tentatively to between 1200 B.C. and 500 B.C. According to Futato (1979:19), occupation of this phase

> seems to have been concentrated in the Pickwick area. In Pickwick, major Bluff Creek occupations were reported for the Bluff Creek site and the Perry site with lesser occupations at other sites (Webb and DeJarnette 1942, 1948b). Bluff Creek phase occupations in the Wheeler vicinity are relatively minor (Webb 1939; Webb and DeJarnette 1948a, 1948b) and probably represent the upstream margins of the phase. Other than its definition by ceramic criteria and a recognition of its similarity to the Late Archaic, little is known about the specifics of the Bluff Creek phase.

The apparent lack of a clear distinction between the inventories of the Bluff Creek and Lauderdale phases suggests that the appearance of ceramics in the Mid-South represented only an incremental change in material culture rather than a revolutionary transformation of the Archaic stage lifeway.

The Transition from the Late Archaic Period to the Woodland Period

The preceding discussion of the Late Archaic period has been organized around the two phases, Lauderdale and Bluff Creek. We have opted not to employ Walthall and Jenkins (1976) "Gulf Formational Stage" for two reasons. First, the Lauderdale phase archaeological data played an important and influential role in the original formulation of the Archaic in the Southeast. As a consequence, the northern Alabama data fit nicely within the traditional scheme. Second, at present, the appearance of fiber-tempered pottery at around 1200 B.C. in north Alabama can be accommodated by placing such "late Lauderdale" sites into a separate Late Archaic period phase, Bluff Creek.

Our avoidance of the "Early and Middle Gulf Formational" terminology is not intended to rebut Walthall's and Jenkins' evaluation that the Southeast was the scene of dramatic and related cultural developments during the Late Archaic. Certainly, the early appearance of fiber-tempered wares in the Stallings Island culture of the Savannah River and the Orange series wares on the St. John's and Indian River in Florida were significant developments. And the later appearance of Stallings Island plain ceramics at the Tensaw Creek site in central Alabama may reflect movement of ideas or people during the Late Archaic.

There appear to be numerous related similarities among Southeastern Late Archaic groups, including riverine-adaptation, seasonal scheduling that focused on "harvesting" shellfish, extensive shell midden development, parallels in horseshoe or circled shell middens, and full inventories. At present, however, the data from sites in the different regions of the Southeast are insufficient to make solid correlations of culture and interpretations of cultural exchange. We are still dealing basically with suggestions and hypotheses that remain to be tested by stratified excavation, a fuller compliment of survey data, and data from pertinent disciplines to address, for example, the degree of climatological influence on Late Archaic cultures.

Consequently, the traditional Late Archaic phases are here retained, the time block between 500 B.C. and 100 B.C. is termed the more familiar Early Woodland period rather than Walthall's and Jenkins' (1976) "Late Gulf Formational".

Although Sears (1948) regards the Woodland period as minimally defined by the presence of Woodland grit-tempered pottery, Willey (1966:267) prefers to define the tradition "not only by its

characteristic cord-marked and fabric-marked ceramics, but also by the construction of burial mounds and other earthworks, and by at least the beginnings of agriculture". In this synthesis, we use a fixed temporal definition of the Woodland as a time period, dating from 500 B.C. to A.D. 1000. However, we accept Willey's threefold criteria as a valid characterizaiton of the cultural stage.

According to Struever (1971:384), the years around the end of the Late Archaic and the beginning of the Early Woodland period are marked by "accelerated technological changes" in many regional cultural sequences. Griffin characterizes the span of time between 1000 B.C. and the birth of Christ as years of "extraordinary cultural growth, population increase, and evidence of exchange of goods in both the Southeast and the Northeast" (1964:237). Yet the cause or causes of this florescence are not certainly understood. It may be as Fowler, Struever (1971), and others suggest, that the domestication of locally-available plant species like sunflower and ragweed and the rest, led to a marked increase in food production, followed by a population increase. On the other hand, Griffin prefers to invoke the introduction of the corn, beans, and squash complex directly or indirectly from Mesoamerica to account for the technical and demographic changes at this time. Finally, Caldwell (1971) prefers to see the growth at this time as due to the effective culmination of the hunting and gathering "primary forest efficiency" which had been developing throughout the Archaic as a nonagricultural adaptation to the region.

The Woodland Period

Whatever the cause, it is safe to say that this accelerated cultural and demographic change after 1000 B.C. reflects the generation of a new and more efficient cultural adaptation to the environment of the eastern United States. At the heart of this new Woodland adaptation was the amalgamation of the pottery, earth mound, and horticultural complexes present in incipient and scattered form in the Late Archaic into a single, coherent cultural synthesis. The economic base of Woodland adaptation seems to have been a combination of horticulture, hunting, and gathering which was sufficiently productive to allow a degree of sedentism and permanence which was generally never achieved during the Archaic period.

Finally, in addition to its effectiveness, the culture of the Woodland period has a singularity in terms of its origins. As Gordon Willey notes

> whereas the Archaic tradition shared many traits with the Desert tradition of western North America, and the general outlines of Mesoamerican culture were reflected in the later Mississippian tradition, the Woodland configuration had no such related counterpart on the New World scene. In this sense, it is the most unique of the three major traditions of the Eastern woodlands (1966:267).

Early Woodland Period

Cultures of the Early Woodland period in northern Alabama are generally distinguished from those of the preceding Late Archaic period by the presence of sand-tempered ceramics of the Alexander series (Griffin 1939; Haag 1942). In addition to sand tempering, Walthall (1980:130) states that Alexander ceramics are characterized by the following "modes":

> globular and vertical sided cup-shaped vessels, tetrapodal supports and annular bases, rim bosses and decorative motifs such as incising, zoning, punctating, rocker stamping and dentate stamping.

These ceramics have been taken by a number of scholars as the hallmark of the Hardin phase which dates to between about 600 or 500 B.C. and 300 B.C. (Dye 1973; Walthall and Jenkins 1976; Futato 1979:19). Aside from the presence of these sand-tempered ceramics, both the cultural inventories and the settlement distribution of Hardin phase sites do not contrast markedly with those of the preceding Bluff Creek phase. Futato (1979:19) concludes that this "continuity (can be) taken to indicate that the change from Wheeler to Alexander ceramics, although dramatic, was indigenous".

Benthall (1965) and Dejarnette, Walthall and Wimberly (1975a) have demonstrated that Flint Creek style projectile points tend to co-occur with Alexander ceramics in the Tennessee Valley. Like the technical continuity which presumably exists between the Wheeler and Alexander ceramics, Flint Creek style projectile points appear to have been derived from the preceding Late Archaic period lithic traditions. These continuities, combined with the apparent paucity of burial mounds dating to the Early Woodland period in northern Alabama (cf., Oakley and Futato 1975 for an alternative view) suggests that the region was fairly isolated from contemporary peoples and events in the Midwest. This being the case, it seems likely that the culture change that took place in northern Alabama during the Early Woodland period was largely an indigenous development rather than a response to external stimulus from the Adena culture.

The Hardin phase in northern Alabama is followed by the Colbert phase which dates to approximately 300 B.C. to A.D. 100 and is characterized by the appearance of limestone-tempered ceramics decorated by patting the wet clay before firing with a fabric-wrapped paddle (Griffin 1946:52; Caldwell 1958). The major types of Colbert ceramics are Longbranch Fabric Impressed and Mulberry Creek Plain (Sears and Griffin 1950; Walthall 1980:144).

The most extensive Colbert occupations known are found in the Wheeler Basin at two sites just outside our project area, the Whitesburg Bridge site (Ma10) and the Flint River site (Ma48)(reported on by Webb and DeJarnette 1948a and b). Both these sites seem to have been positioned to take advantage of floodplain resources, and the

quantities of shell remains recovered from both sites indicate that freshwater mussels were an important subsistence item during the Colbert phase. However, according to Nielsen (1972), in addition to these valley bottom sites, Colbert phase occupations are located on the smaller tributaries of the Tennessee well back from the main channel. Presumably, these terrace village sites represent fall or winter occupations in which a different set of resources was being exploited. Although we have little other direct information about subsistence, the apparent increase in the raw numbers of Colbert sites over those of the preceding Hardin phase supports a conclusion that the Early Woodland subsistence system was an efficient one.

As noted, the presence of shell middens points to at least a partial reliance on shellfish resources and, as Walthall (1980:147) points out, it is entirely possible that floodplain horticulture was practiced. He cites Miller's (1958) report of a charred basket containing *chenopodium* seeds in a Middle Woodland component at Russell Cave as possible support that floodplain horticulture may have begun to play a role in subsistence patterning during the Early Woodland. However, the presence of sites away from the floodplain tends to indicate the Early Woodland occupants had an economy based on seasonal scheduling to take advantage of a variety of resources available in different environmental niches.

Data from Clayton's (1965) excavations at nine rockshelters revealed Colbert phase ceramics to be the dominant pottery type. Associated artifacts include mortars and milling stones and projectile points. While gathering may be inferred from the groundstone tools, hunting also appears to have been practiced since projectile points were found in the rockshelters, and deer comprised the majority of the faunal remains.

A seemingly important aspect of the Colbert phase is its shared traits with preceding phases. For example, steatite and sandstone vessels were associated with Colbert occupations, representing the final use of stone containers in the Middle Tennessee Valley (Walthall 1980:148).

Middle Woodland Period

The Colbert phase was followed by the Copena phase which dates to between about A.D. 100 and A.D. 500. This phase was first defined by Webb (1939) based on his work in the Wheeler Basin. Subsequent work in the lower valley of the Tennessee River has produced additional Copena phase sites (Webb and DeJarnette 1942; Webb and Wilder 1951) and recent work by Walthall (1972, 1973a, 1973b, 1974), Walthall and DeJarnette (1974), and Walthall, Stow, and Karson (1980) have further refined our conception of the phase and placed it firmly in its proper chronological position.

With the onset of the Copena phase, northern Alabama seems to have entered into a close interaction with the Middle Woodland period

Hopewell culture(s) of the central Midwest. Perhaps partly as a consequence of this interaction, Copena phase culture became what Walthall, Stow, and Karson (1980) call

> the most extensive Middle Woodland manifestation in the Southeast (since) some 50 burial mounds and seven natural cave tombs have been reported from the Copena core area in the Tennessee Valley region of northern Alabama.

The bulk of our data on the Copena phase has been derived from the justly famous mound and cave mortuary sites referred to by the above authors. Copena mounds, one of which (1Ma49) lies within the present project area, are generally relatively small by the standards of the Ohio and Illinois country. DeJarnette (1952:278) describes their construction as follows:

> Before beginning the actual mound construction, Copena adherents usually buried separately several individuals (precendent burials) in long, oval pits. They would shape each pit with care and make the bottom level; then they would floor the bottom with a layer of clay, spreading the clay by puddling it. Sometimes they would shape a low clay 'pillow' and foot rest. They would then lower the body (in an extended position, face upward) into the grave, and after placing with the body carefully arranged burial offerings, they would often completely seal both body and offerings with another layer of clay. Sometimes they would place small logs on either side of the body; at other times they might cover the body with bark. Leaving piled beside the grave the earth they had thrown up in digging it, they would bring sand and clay from elsewhere to refill the grave. After they had made in this manner a number of closely grouped burials, the Copena people began the actual mound construction, bringing sand and clay to cover all the graves in the group, and covering also the heaps of earth that had been piled up in digging the precedent graves. As they deposited the sand and clay, and before any definite mound had been formed, they would add other burials (intrusive burials). In making these intrusive burials they sometimes flexed the body fully, sometimes extended it, sometimes laid down lone beads or skulls, or disarticulated body members or bones. Sometimes they laid down fragments of bodies that had been cremated.
>
> When their deposits of sand and clay had accumulated to a moderate size, mound construction was completed with a final capping of sand and clay, after which no further burials (no intrusive burials) were added.

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These mounds have produced large quantities of high quality artifacts which presumably were largely reserved for use by an elite class. Copena burial furniture includes copper sheets, reel-shaped gorgets, earspools, beads, bracelets, celts, breastplates, and other objects; marine and aquatic shell artifacts; galena nodules both in their natural state and ground into discs, spheres, or beads; wooden bowls and trays; steatite pipes; finely worked projectile points and greenstone celts; and a variety of other objects. Other than their fine workmanship, the two most significant things about these artifacts are:

1) their almost exclusive occurrence in mortuary contexts such as mounds and caves.

2) the non-local origin of the raw materials of which many of them have been fashioned.

The first point of course suggests that such items are status markers designed to symbolize or underscore the position of the individual or corporate owners with whom they were buried. Of course, the interment of such high-status items in the graves with the deceased owner probably meant that the survivors who inherited the deceased's position were forced to work to accumulate such items for themselves. The distant origin of the raw materials of which many objects were fashioned---galena from northern Illinois (Walthall, Stow, and Karson 1980), copper from the northern Great Lakes (Goad and Noakes 1978), and marine shells from the coast---suggests that the "cost" of such items must have been considerable. No doubt this cost was at least the partial reason for its high-status attribution. The Copena mortuary data also strongly indicates that the relative insularity of northern Alabama ended by the Middle Woodland period when the region became an important location within the pan-regional "Hopewell Interaction Sphere".

Copena habitation sites include open-air villages in or near the bottomland and upland rockshelter camps (Walthall 1980:159). Both site types contain high percentages of limestone-tempered plain and carved paddle-stamped ceramics. Minor frequencies of fabric-impressed, cord-marked, brushed, and rocker-stamped pottery also occur. The geographic distribution of these ceramics is particularly interesting in that they reflect developments of the succeeding Late Woodland period. The cord-marked, brushed, and rocker-stamped wares are all found in the Copena territory east of Green Mountain where in Late Woodland times, plain and brushed limestone-tempered pottery became, according to Walthall (1980:149) "the major finish treatment". Walthall suggests that the data may indicate that Hopewell influence was arriving in the area via the Great South Trail that connects with a series of trails between the Ohio Valley and the Tennessee Valley near the mouth of Flint River. He notes further that the differential distribution of ceramics may suggest that Copena was composed of two autonomous tribes. Whether this hypothesis has validity remains to be tested.

Late Woodland Period

By A.D. 500, with the onset of the Late Woodland period, the Copena phase gives wav to the McKelvey phase in northern Alabama and to the Flint River ﾠ se in the northeastern portions of the state. The construction of burial mounds seems to have halted by this time, and limestone-tempered ceramics were replaced by sherd-tempered pottery in the areas west of Green Mountain. Green Mountain is an apparent division between the McKelvey and Flint River phases of the Late Woodland in this region. The McKelvey phase, to the west of Green Mountain, is characterized by cord-marked, check-stamped, and plain pottery (Walthall 1980:174). Two major McKelvey phase sites occur in the vicinity of the Wheeler Reservoir and were excavated during the W.P.A. period: the Hobbs Island site (Webb 1939) and the McKelvey village (Webb and DeJarnette 1942). While the former site produced only scattered postmolds and middens, evidence of substantial structures were found at the latter location. As regards Mckelvey phase subsistence, Walthall (1980:177) states:

> While there is yet no direct evidence of cultigens from McKelvey sites, maize and squash were probably grown by these peoples. In fact, the McKelvey settlement patterns almost duplicate that of later Mississippian peoples. At nearly every site in the Pickwick and Wheeler basins where McKelvey ceramics are found, shell-tempered Mississippian pottery is also present. It appears reasonable to infer a similar economic base for both groups. McKelvey floodplain settlements, both in the Tennessee Valley proper and in upland tributary valleys, appear to represent small farming villages or hamlets while upland rock shelters, such as Stanfield-Worley and Buzzard Roost Creek, served as temporary hunting and collecting camps.

Despite the apparent similarity between McKelvey phase and later Mississippian period settlement (and presumably subsistence) patterns, Walthall (1980:179) sees no evidence for what Faulkner has referred to as a process of "Mississippification" of Late Woodland period cultures. Instead of this acculturation process, Walthall concludes that major portions of the Middle Tennessee River Valley in northern Alabama were abandoned near the end of the Late Woodland period McKelvey phase and were re-occupied much later by peoples possessed of a fully-developed Mississippian cultural system.

East of Green Mountain, the Late Woodland occupation is represented by the Flint River phase. This phase differs from McKelvey in the continuation of the limestone-tempered pottery characteristic of Copena. Plain and brushed wares are the most prevalent, this brushing technique having its roots in the earlier Copena phase where it comprised only a minor decorative technique.

Flint River phase settlements are represented at a large number of sites both in the river valley and upland locations. Semi-permanent occupation over a long period of the year appears to have been the rule (Walthall 1980:172). Interestingly, there is no evidence of ceremonials, although Walthall (1980:172) cautions against assuming that Flint River culture was not ceremonial since such activity may have centered around the use of perishable objects that might now be only recovered in protected environments such as dry rockshelters.

The Mississippian Period

Sometime after 700 A.D., a new cultural tradition began to emerge, most likely within the central Mississippi River drainage in northeastern Arkansas, southeastern Missouri, northwestern Mississippi, southern Illinois, and western Tennessee. The most dramatic elements of this new tradition were the construction of temple mounds of great size around formal plazas, the dense packing of square to rectangular residential structures beyond these plazas and the common encirclement of the entire temple-plaza-village complex by large wooden stockades, even moats and ditches. In addition, the Mississippian tradition is characterized by the manufacture of shell-tempered ceramics (which are often plain, but were also painted and elaborately modelled), and the appearance of new artistic media and concepts. It is generally assumed that this cultural configuration resulted in part from an expanded reliance on the cultivation of domesticated plant species including maize, beans, squash, pumpkin, sunflower, and gourds, the source of which, with the exception of sunflower, was ultimately Mesoamerica (Griffin 1964:248-249, 1967; Smith 1975:1-3).

The presence of this Mesoamerican corn, together with numerous other cultural elements of similar derivation, such as the plaza-temple complex and artistic motifs such as feathered serpents, dancing birdmen, speech scrolls, and skull-and-bone designs, all present difficult interpretive problems. While it is of course tempting to invoke the deux machina of migration, or of widespread trade between Mexico and the Mississippi drainage, it must be noted that we have neither evidence of site-unit intrusions of Mexican peoples, nor artifacts of actual Mexican manufacture in the sites of the Southeast. Nonetheless, the clearly Mesoamerican character of so much of the Mississippian cultural system has led some scholars to postulate that it was the renewal of contact and influence with the high cultures to the south after A.D. 700 which actually spurred the development of the Mississippian tradition in the first place (Spencer and Jennings et al. 1977:410). Suffice it to say that, in its fully-developed form in the central Mississippi drainage, the Mississippian tradition combined numerous "Mexican" elements in its art, architecture, subsistence economy (and, apparently, in its ideology), with a number of more or less autochthonous Southeastern cultural patterns.

Perhaps the most dramatic element in this cultural synthesis was the construction of squared, flat-topped or truncated, pyramidal earth mounds. Although these mounds still served as tombs or grave markers

for high-status individuals, as in Woodland times, they seem primarily to have been built as platforms or "substructures for important religious or civic buildings" (Fowler 1969:365). Such temple mounds generally show signs of having been rebuilt and enlarged numerous times; and, as Jennings (1952:264-265) put it, "each rebuilding or addition served as a foundation for one of a series of successive temples or other structures." The scale, as well as the function, of earth mound construction changes between Woodland and Mississippian times. The largest mound on Mississippian sites generally rises between 10 and 20 meters (30 and 60 feet) above the ground (Jennings 1952:264-265). Of course, Monk's Mound at Cahokia rises through four terraces to a height of 33 meters (100 feet) above the ground surface to make it the largest mound or pyramid in North America, and the third-largest prehistoric structure in the New World (Ford 1974:405).

The internal site "community pattern" found at late Mississippian sites contrasts with the Woodland form also. In the earlier Woodland sites, burial tumuli generally occurred either singly or in loosely-grouped clusters, at Mississippian sites:

> the square, flat-topped eminences were usually grouped so as to outline a hollow square or plaza. The plaza and mounds were the heart of a religious center where it is assumed a sacred governing caste of priest-rulers dwelt (Jennings 1952:265-266).

The orientation of the plaza or courtyard was roughly north-to-south along long axes, which ranged between about 61 to 122 meters (200 to 400 feet) in length (Rodgers 1973:101). Generally, the dominant or major mound at the site was situated on the west side of the plaza (Wicke 1965:411-412). Access to some of these mounds was obtained by means of sloping earth ramps, which opened on the plaza. Usually these ramps were single, but double ramps are known from Hiwassee Island and other sites, where two superstructures had been built on the mounds (Wicke 1965:411-412). In addition to the mound-plaza groups, other apparently "public" structures are known from Mississippian sites, including mortuaries or ossuraries, "sweathouses" (Peebles 1978:377), "rotundas" such as the Macon earth lodges reported from central Georgia (Fairbanks 1946), and "woodhenges" such as the structure reported by Wittry (1969) from Cahokia. This latter structure has been interpreted as a celestial observatory, utilized in calendric time reckoning.

Both the scale and central location of the mound-plaza groups lead most scholars to conclude that they were the loci of the civic and religious authority at Mississippian period sites. In addition, Peebles presents mortuary evidence suggesting that the mound-plaza community pattern also reflects the status hierarchies formerly present in Mississippian social systems. At least at the site of

Moundville in northern Alabama, the second largest known Mississippian site after Cahokia, Peebles (1978:381) states that

> the highest-status burials are found in the mounds, and, in general, as the distance from the northernmost mounds increases, the average status of the burials decreases. In brief, the status-space, defined by the burials, is paralleled by the distribution and variety of dwellings and artifacts.

Peebles (1978:399) and a number of other scholars (cf. Smith 1976) also note that , in addition to such intra-site structural (and presumably social) variability, a good deal of structural variation is evident between contemporary Mississippian period sites. For example, the huge site of Moundville seems to be the focus of a "settlement hierarchy" in which a number of lesser centers cluster in its vicinity. It seems likely that the residents of these lesser centers depended upon Moundville for a variety of economic, political, and religious services much as the residents of modern small towns look to the major cities for the performance of the key manufacturing, distributional, and political functions on which their existence depends.

In any event, at the primary and secondary Mississippian centers, the mound-plaza ceremonial cores were surrounded by densely-packed, square to rectangular residential structures generally measuring between 3.6 and 6 meters (12 and 20 feet) on a side (Smith 1975:2). Both the numbers and the size of these residential units has led Fowler (1969:365) and other scholars to conclude that the Mississippian period was characterized by a population explosion. Although estimates vary, the largest Mississippian site, Cahokia, located in the American Bottoms near St. Louis, very likely supported a resident population of 30,000 or more persons (Ford 1974:405). By the Late Mississippian period, these large and compact mound-plaza-village settlements were commonly encircled by large wooden stockades, and even ditches and moats.

Whatever the cause, the presence of stockades, moats, caches of severed heads, burials with traumatic injuries, and other evidence of violence found at so many sites of the period suggest that warfare figured greatly in the lives of the Mississippian peoples.

On another tact, these same stockades and moats, together with the scale and formal planning generally found at the larger Mississippian sites, may be taken as prima facie evidence that the political organization which developed during the period was often centralized and authoritative (Sears 1968; Pfeiffer 1973). Further, the marked differences in the location and treatment of the dead suggest a stratified, or at least ranked, social system (Fowler 1975:97-98).

The scale of Mississippian public architecture and site layout, coupled with the lavishness of interments of special individuals, are

the primary data used in assessing the complexity of their political organization. However, another potential indicator of organizational strength can be found in the quantity, diversity, and quality of their crafts and manufactures. Certainly, one of the most important of these crafts was pottery making. Mississippian sites are generally characterized by great quantities of sherds, which continue grit-tempering, but also exhibit a new tempering medium, shell (O'Brien 1972b:Table 6).

In addition to plain utilitarian ceramics, Mississippian potters also made elaborately decorated ceramics. According to Sears (1964: 278), "most decorative techniques, except stamping or paddling, (were) used, including simple versions of incised, punctated, and modeled styles that had been common in the Southeast for centuries." Special, presumably non-utilitarian, vessel forms included human and animal effigy pots, strap handle pots, stirrup-spout vessels, and tripod pots. Mississippian ceramics were often painted, elaborately carved, modeled and incised. It is the quality of the craftsmanship shown in the manufacture of these latter vessels which suggests that full-time ceramic-making specialists were present in Mississippian society, at least in the larger centers, like Cahokia (O'Brien 1972b:190). In addition to ceramics, Mississippian craftsmen also worked in other media, such as copper, stone, and shell. Although we have precious little evidence, they no doubt worked with basketry, textiles, feathers, leather, wood, and other media of which very little has been preserved. The variety and quality of workmanship in these media also suggest that such crafts were pursued as full-time specializations. If such specialization can be demonstrated to have been common in Mississippian sites, it would be further evidence that the period was characterized by stratified sociocultural systems at the state level of complexity.

Whatever the sociocultural level of the Mississippian systems, it is certain that they were supported by an efficient and highly-productive economy. However, the precise nature of that economy has yet to be fully understood. Traditionally, it has been assumed that the period witnessed an expansion in the reliance on the key Meso-american cultigens of beans, squash, gourds, amaranths, pumpkins, and new varieties of corn as well as such native plants as sunflowers and perhaps sumpweed. While there is no question that midden material recovered from Mississippian sites contains abundant quantities of the remains of these plants, Muller (1978:307-308) and Smith (1978:483) stress that wild plant products, particularly nuts such as acorn, walnut and hickory, fruits including persimmons, cherries, plums, and hackberries, and a variety of seeds all remained exceedingly important elements in the southeastern aboriginal diet well into historic times.

In addition, game continued to be a critical element in the Mississippian diet. In an examination of the faunal remains from seven Middle Mississippian sites, Smith (1975:9) found that over 100 different species of wild vertebrates appear to have been hunted. However, as Smith (1975:121) notes, "13 species/species groups

accounted for 92 to 99 percent of the total meat yield represented at each of the seven sites being considered." Included within this are: fish and turtles, migratory waterfowl, rabbit, bear, squirrel, beaver, deer, raccoon, wild turkey, and opossum. Based both on the relative abundance of their remains in Mississippian middens and the quantities of meat that each individual represents, Smith (1975:127) concludes that the most important wild animal species in the Mississippian diet were whitetailed deer, raccoon, wild turkey, and opossum in that order. The agricultural basis of Mississippian life can clearly be observed in the extensive "ridged-field" systems noted by Fowler (1969), Kelly (1938), and others, in association with Mississippian sites. It is further reflected by Muller (1978:309), in the observation that late prehistoric Mississippian sites

> in Illinois and Indiana, for example, are in riverine extensions of the Southeastern environments, as shown by their location just inside the southern limits of the area where cypress trees grow.

Since important wild plant resources, such as hickory nuts, and animals, such as deer, are abundant outside the areal range of the cypress tree, it seems likely that the major impediment to the spread of the Mississippian system in the Midwest was the limited adaptability of its cultivated plants. Further, it is interesting to note that, of the 13 species or species groups which Smith (1975) considers to have provided the bulk of the animal protein in Mississippian diets, eight most likely were hunted between about October until early April. The concentration on species available during the winter suggests that Mississippian peoples had chosen to concentrate on those animal species whose availability conflicted least with their schedule of planting, cultivating, and harvesting.

As a consequence of the importance both of agricultural pursuits and hunting and gathering of the limited assemblage of 13 species or species groups, Smith (1978:480) suggests that the Mississippian cultural system became closely adapted to virtually a single environmental setting: the "meander-belt zone" habitat of the Lower Mississippi River and its major tributaries. Smith (1978:481) characterizes this zone as composed of "linear bands of circumscribed agricultural land and concentrated biotic resources" and states that the specific location of any particular Mississippian settlement within the zone was a function of two major factors:

> 1) The availability of well-drained, easily tilled,... natural levee soils suitable for horticultural garden plots.
>
> 2) Easy access to the rich protein resources of fish and waterfowl in channel-remnant oxbow lakes (Smith 1978: 488).

Certainly these two classes of territory were capable of producing resources sufficiently abundant and predictable in space and time to render it practical for Mississippian social groups to maintain fixed territories around them.

Perhaps the final major event in Mississippian culture history was the emergence and spread of the so-called "Southern Cult," or as it is currently known, the "Southeastern Ceremonial Complex (SECC)." This complex emerged and flourished sometime after approximately A.D. 1000 until A.D. 1500 in the central and southeastern portions of the East (Griffin 1966:127). Stoltman ((1978:727), following Griffin (1967: 190), McKenzie (1966), and Brown (1976:123-125), firmly date the inception of the Southern Cult in the Southeast to A.D. 1200 and use its appearance as a major horizon marker for what he calls the "Late Florescent subperiod" dating to between A.D. 1200 and A.D. 1600. Although I am not altogether comfortable with this late date for the emergence of the Cult, I have followed Stoltman's usage for consistency's sake and date the "Late Mississippian period" as he does with the appearance of the SECC at A.D. 1200 as the horizon marker.

In any event, according to Willey (1966:304), the Southern Cult consists of "a series of iconographic elements and objects which are associated as a complex, and which apparently pertained to religious ritual." That is, after about A.D. 1000, across a wide area of the Southeast centering on the Mississippi drainage, there appeared a rather uniform series of associated artistic motifs and artifacts which suggest "the material trappings of a widely-shared religious tradition" (Newcomb 1974:36).

In many ways, the SECC represents another resurgence of the older eastern North American religious emphasis on mortuary practices, expressed earlier in such traditions as Adena and Hopewell. Webb and Baby (1957:102-108) note, for example, that certain SECC forms originated first in the Adena tradition, and only resurfaced with the rise of the cult more than a millenium later. However, the mortuary practices associated with the Southern Cult seem to have been on a far grander scale, and seem to have involved more elaborate grave furniture, than the rituals of the previous Woodland periods. Further, the SECC incorporates a variety of cultic symbols, decorative motifs, and supernatural characters which reveal a heavy and distinctive Mesoamerican influence (Waring and Holder 1945:31; cf. Kreiger 1945 for an opposing interpretation).

Presumably, the Mesoamerican and native North American elements that make up this horizon-style were originally integrated or synthesized into a coherent whole somewhere within the Mississippian culture's heartland along the central Mississippi River drainage (that is, in the Mississippi-lower Ohio-Cumberland-Tennessee River country of the mid-South and midwest. However, the SECC spread well beyond this nuclear area, into Georgia at Etowah and Macon Plateau; to the Spiro site on the Arkansas River in Oklahoma; south to Alabama at Moundville and to Florida at sites like Mount Royal and St. John II

(Willey and Phillips 1958:166). Precisely how widespread were the cult membership and practice among the peoples surrounding these great sites remains unclear. As Sears (1964:279) notes, "most of the objects in or bearing on these styles (SECC) have been recovered from a few graves in a few structures in a few major ceremonial centers." But he interprets this as indicating that the SECC became a kind of state religion, whose worship and service were concentrated in a few major ceremonial capitals, to which the surrounding population would repair on specific ritual and ceremonial occasions (also cf. Howard 1968).

A closely-associated set of recurrent and apparently interrelated set of symbols or motifs constitutes the core of Southern Cult iconography. These symbols, as originally identified and defined by Waring and Holder (1945:2-6), include the forked or weeping eye, the open eye, the bi-lobed arrow, the cross with a sunburst circle, the cross, the hand-eye (human hand with an eye or cross element in the palm), death motifs (human skulls, bones, or skeletal hand-and-eye motif, with human long bones). In addition, the cult contained a series of god-animal or man-animal representations, which consist of animals in both anthropomorphized and naturalistic form. These representations include anthropomorphized eagles, plumed or winged serpents, naturalistic rattlesnakes, cats, birds, and a variety of other beings.

These motifs or symbols were commonly engraved, carved, or otherwise associated with a group of special purpose or ceremonial objects, which included polished black, shell-tempered Mississippian pottery, shell gorgets and other jewelry (Willey 1966:305), conch shell masks, stone palettes and statues, stone and ceramic effigy pipes (Newcomb 1974:42), shell and copper gorgets, embossed copper plates, ear spools, hafted celts and monolithic axes, mace-like batons, ceremonial flints and other materials (Waring and Holder 1945:6). Such materials have been recovered in large quantities from spectacular grave sites or ceremonial caches from a variety of major sites in the Southeast.

By the end of the fifteenth century, the vigor and uniformity of the Mississippian tradition had begun to wane, and, in a number of areas, local styles had begun to reassert themselves (Caldwell 1971:376; Stoltman 1978:727). Further, a population decline was apparently correlated with this cultural degradation, and this had led some scholars to speculate that climatic oscillations detrimental to the Mississippian agricultural adaptation may be the cause. In any event, mound-building seems to have largely disappeared in eastern and North American by the early Historic period, with the exception of the Natchez and a few other groups. Consequently, it is difficult to relate the many historic Indian groups in the region directly to their presumed Late Mississippian period predecessors (cf. Stoltman 1978: 727-728 for a more sanguine view of the final years and the ultimate fate of the Mississippian tradition).

As has been obvious throughout this discussion of the cultural sequence in northern Alabama, our understanding of the prehistory of the area is largely based on the work done in the Lower Valley of the Tennessee River during the WPA-TVA period. In most instances, this corpus of data proves to be a mine of information; unfortunately, in the case of the Early Mississippian period, it seems to break down. Although the occupations assignable to this period are known from the Black Warrior River to the south and in the Guntersville basin to the northeast, no Early Mississippian period sites have been reported from either the Pickwick or the Wheeler Basin proper. Rather than assuming a cultural hiatus, Walthall (1980:267) concludes that the absence of any Early Mississippian period traits in these areas is due to sampling error during the WPA-TVA investigations. According to him,

> During the WPA-TVA salvage program, time and money allowed investigation of only shell mounds, burial mounds, and other large or impressive sites. Literally hundreds of smaller sites, including many habitation areas, were located during the survey but not excavated.

Walthall (1980:267) goes on to note that in the Western Valley of the Tennessee River north of the Wheeler Basin, an Early Mississippian period manifestation known as the Harmon's Creek phase is characterized by small dispersed hamlets and farmsteads rather than large and impressive mound-plaza groups. He suggests that such a settlement pattern probably characterized Early Mississippian period peoples in northwestern Alabama and that these unimpressive sites were ignored during the WPA-TVA surveys. If the Wheeler Basin was occupied by peoples with a cultural system analogous or even related to the Harmon's Creek phase peoples further north, it is perhaps likely that they too were Late Woodland peoples becoming "Mississippianized" through contact and interaction with the more advanced peoples of the Mississippi Valley (cf. Faulkner n.d.; Kneberg 1952). Presuming that such "emergent" Mississippian peoples were present in the Wheeler Basin, we have followed Walthall (1980:267-268) in provisionally including them in the Langston phase recognized for the period in the Guntersville Basin.

Definite Mississippian period occupation in the Wheeler Basin begins with the Hobbs Island phase (Webb 1939; Futato 1979:23). This phase dates to the Late Mississippian period and appears to last from approximately A.D. 1200 until about A.D. 1500. It is contemporary with the Kogers Island phase in the Pickwick Basin (Webb and DeJarnette 1942, 1948) and with the Henry Island phase in the Guntersville Basin (Webb and Wilder 1951). Webb (1939) reported three major Hobbs Island phase sites in the Wheeler: Hobbs Island site, the Tick Island site, and the Whitesburg Bridge site. In addition, a fourth: the Wallings II site is located north of the Tennessee River about a mile from the Whitesburg Bridge site. Designated Ma^{o}31, Ma^{v}31, and Ma^{o}32 (Plate 2), the site consists of two mounds and a village. This site lies within the project area and is more thoroughly discussed in

PLATE 2. MOUND 1MA°32, LOOKING WEST PRIOR TO EXCAVATION IN 1941. Courtesy of the Office for Archaeological Research, Moundville, Alabama.

Chapter 8. Another mound, Ma^{o}50, is located about 609 meters (2000 feet) west of Ma^{o}32 and, although it contains earlier building stages, was also occupied during the Mississippian stage as with Ma^{o}31, Ma^{v}31, and Ma^{o}32. Ma^{o}50 is also located in the project area and described in Chapter 8.

Significantly, two of these mound sites, Ticks Island and Hobbs Island, contained true conical burial mounds more reminiscent of the Copena phase than the Late Mississippian period (Walthall 1980:284-285). In addition to conical mounds, Hobbs Island phase sites often contain truncated pyramidal mounds which apparently supported both residential and temple structures. Burials within these mounds and those in the conical mounds were generally accompanied by elaborate grave goods of shell-tempered pottery and shell gorgets which were often "engraved with designs of the Southeastern Ceremonial Complex including the sun symbol, spider and turkey cock" (Futato 1979:23).

Following the seriational work on Southeastern Ceremonial Complex motifs done by Kneberg (1952) and McKenzie (1966:46), Walthall (1980:294) compares the SECC motifs on Hobbs Island Phase pottery with those from the sites of the Moundville Phase and concludes that the two phases were contemporary. If this were the case, it seems likely that the somewhat less-imposing sites of the Late Mississippian period in the Wheeler Basin had fallen under the influence, if not the political control, of the immense site of Moundville. This site, located on the Black Warrior River near Tuscaloosa, seems to have been second in size and richness only to Cahokia in eastern North America. It is far and away the most impressive Late Mississippian period site in the Southeast. The major ceremonial and settlement areas of the site spread over approximately 300 acres and include 20 pyramidal mounds, a huge plaza, four artificial ponds which may have served as fish tanks, charnel houses, sweat houses, residential structures, and over 2,200 known burials surrounded, at least in part, by a stockade and ditches (Squire and Davis 1848; Moore 1905, 1907; McKenzie 1964a, 1964b, 1965a, 1965b, 1966; Peebles 1970, 1971, 1978; Peebles and Kus 1977; DeJarnette and Peebles 1970).

3. ETHNOHISTORY OF THE MIDDLE TENNESSEE RIVER

By

Jeffrey H. Altschul

Only a few small settlements dotted the middle reaches of the Tennessee River when Hernando DeSoto first explored the region in 1540 (Figure 3). Rather than reflecting an inhospitable environment, this situation was the result of prevailing intertribal boundaries and animosities. At the head of the Tennessee River, to the north and east, were located the various bands of the Cherokee; downstream were the towns of the powerful Chickasaw; while bordering both groups to the south, were the diverse settlements of the Upper Creek Confederacy. The often bitter relations between these groups had left the middle sections of the Tennessee River a political vacuum. Those bands which chose to settle the area were either small splinter groups from one of the more powerful surrounding tribes or bands of intrusive Indians who had seized the opportunity to move into the environmentally rich area. Most of these settlements were short-lived, with the groups eventually gravitating back to their homelands or periodically being forced out by encroaching bands.

Though uncertainty and instability characterized settlement along the middle Tennessee River, these aspects alone should not be allowed to overshadow the basic cultural similarities shared by the diverse groups. All the tribes practiced identical subsistence patterns, maintained similar social and religious institutions, and spoke related languages. Moreover, from 1540 until their removal to the west, each tribe was forced to adjust to a common disrupting factor, the European presence. Though each tribe's experience was somewhat different, all eventually tried to escape by retreating before European advances. Unwittingly, this common practice forced them to confront each other along the middle reaches of the Tennessee just before their final collapse. The events which transpired therein document the final attempts of these cultures to adapt to the dominating Europeans, and provide insights into the nature of the cultural resources left behind.

Tracing the locations and movements of the various ethnohistorical tribes is based on the scanty descriptions of the early explorers and their poorly developed cartographic skills. Throughout much of this period, many tribes can only be placed relative to better known neighbors, often using tenuously based inferences. What is clear is that when DeSoto descended the Tennessee River in the summer of 1540, he noted near the headwaters, Indians belonging to the "Province of Chalaque or Xalaque", and further downstream on an island near the present Tennessee-Alabama border, groups affiliated with the "Province of Chiacha". Though DeSoto makes no mention of visiting towns in either province, it is known that in 1567, Spanish explorers under Pardo observed two major settlements on the Tennessee River, the

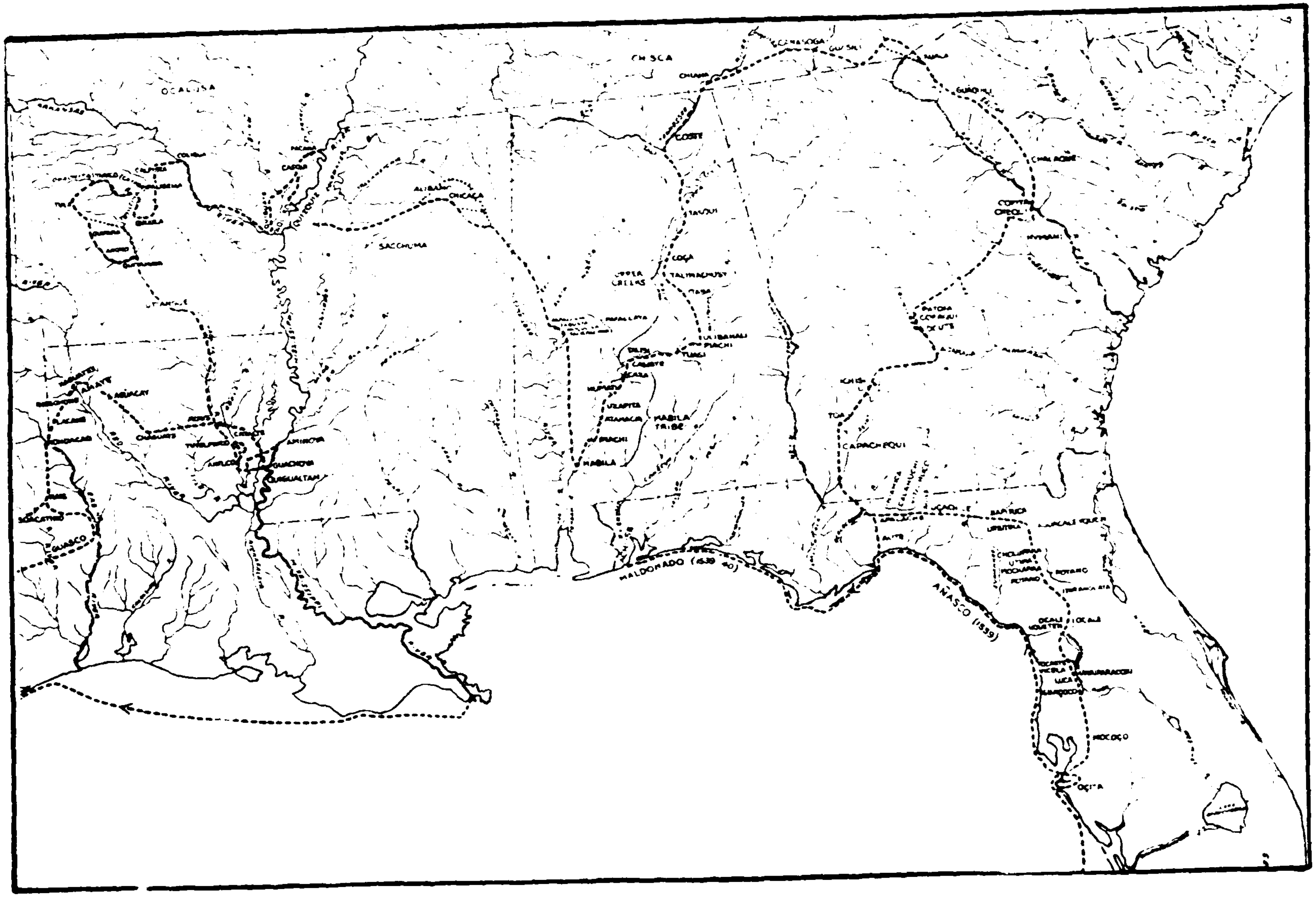

FIGURE 3. ROUTE OF HERNANDO de SOTO AND LUIS de MOSCOSO THROUGH THE SOUTHEAST. (From Swanton 1946).

stockaded town called Tanasqui and a large village on Burns Island. Tanasqui was most likely a Cherokee town belonging to DeSoto's province of Chalaque, while the Burns Island settlement was probably the base of the Chiacha, a small tribe associated with the Creek Confederacy. DeSoto noted that the Chiacha were subject to the "chief of Coca", indicating perhaps that the Creek Confederacy was already in existence by 1540. This fact coupled with the defensive nature of the settlements suggests that strained relations between the Creeks and Cherokee predate the arrival of the Europeans.

The first Indian tribe that DeSoto explicitly mentions visiting on the Tennessee River was the Koasati on Pine Island, about 15 miles northeast of Triana. On Pine Island, DeSoto took the Koasati chief hostage, extracting from him knowledge of the rich "Chisca" to the north. Two soldiers were dispatched to explore this province, natives of which subsequently have been identified as the Yuchi Indians (Swanton 1922, 1946). At this time, the Yuchi were divided into two groups, one centered along the western flanks of the Appalachians and the other later found at Muscle Shoals on the Tennessee River, 30 miles west of Hobb's Island.

From Pine Island, DeSoto descended the river as far as the Great Bend, where he found a band of Cherokee, the Tali, encamped on an island. At this point, DeSoto's party left the river trekking south overland to the Coosa River (DeJarnette 1958). Midway between the Tennessee and Coosa Rivers, DeSoto encountered the village of Tasqui, another band belonging to the Creek Confederacy. Scarcely 30 years later, in 1567, Pardo's expedition found not one, but two, villages in this general vicinity, Tasqui and Tasquiqui. Both these settlements were probably towns of the Tuskegee, a minor Creek tribe, which was undergoing a major schism. Ultimately, the tribe would split with one village moving to the Coosa River and the other settling along the Tennessee (Swanton 1922).

After leaving the Tuskegee, DeSoto made his way west, eventually encountering the powerful Chickasaw at the headwaters of the Tombigbee and Tallahatchie Rivers. Nearly destroyed by his Chickasaw hosts, DeSoto escaped to the Mississippi River where he was taken in by the Casqui, an Indian group near Helena, Arkansas, which has been tentatively identified as the Kaskinampo (Swanton 1930).

While many of the tribes mentioned above were not located on or near the Tennessee River in 1540, by the close of the seventeenth century, all of them had settlements along the river. The exact reasons accounting for the widespread settlement upheavals of the late sixteenth and the seventeenth centuries will probably never be fully understood. With the exception of Pardo's 1567 expedition, European exporation of the area was suspended until late in the seventeenth century. By that time, the Kaskinampo had moved across the Mississippi, up the Cumberland River, and then south to an island near the Great Bend of the Tennessee River. Once settled on the Tennessee, the Kaskinampo continued the move up river. By 1701, they

had relocated on the southern end of Pine Island. While most of the Koasati had moved to the Coosa River in 1686, the remnants of the tribe still maintained a settlement on the northern end of the island. Eventually, the Koasati and Kaskinampo merged. But the two tribes were unable to withstand pressure exerted from their more powerful neighbors and, continuing upstream, they were finally absorbed into the Cherokee nation.

The Koasati and Kaskinampo were not the only tribes to join the Cherokees. The major split among the Tuskegee sent half the tribe north to resettle on Long Island, Monroe County, Tennessee. The Tuskegee, like most other small unaligned tribes found along the Tennessee River were able to keep their independence for only a short time. By 1701, the Tali and Yuchi had joined the Tuskegee near the headwaters of the Tennessee; and within a decade, all three tribes were absorbed by the Cherokee nation (Fleming 1976). Among the small tribes, only the Chiacha were completely forced out, vanishing among related Creek tribes in Georgia.

The major factor behind the eastward movement of the small tribes was undoubtedly the resettlement of several Chickasaw bands near the mouth of the Tennessee River between 1690 and 1700. The smaller tribes were simply no match for the more aggressive and powerful Chickasaw. Though the Chickasaw never inhabited most of the middle Tennessee River Valley, it is clear that they claimed exclusive rights, which they jealously protected, over the area (Gibson 1971).

The withdrawal of the smaller tribes left the area virtually uninhabited. This situation was exploited by the Shawnee, traditionally located in the Cumberland River Valley to the north. Between 1660 and 1715, small bands of Shawnee descended into the Tennessee Valley. Almost from the start, poor relations existed between the Shawnee and the Cherokee. By 1690, it had become an annual custom for the Cherokee to raid the Shawnee during January and February (Webb 1939). The Shawnee flourished in the region, building several permanent settlements, the principal one along the Tennessee River on Beard's Bluff, about 20 miles east of Triana (Street 1904). Once the Chickasaw moved to the Tennessee, the Shawnee were badly outmatched. In 1715, the Shawnee were expelled from the region reputedly by a combined Cherokee-Chickasaw force, though neither of the victors recognized the other's actions. Except for an aborted attempt to raid the Chickasaw in 1747, the Shawnee remained well outside the Tennessee River region.

By 1715, the balance of power along the Tennessee River was divided between the Cherokee near the headwaters, and the Creeks to the south. The Chickasaw would begin to slowly move eastward toward the middle Tennessee River Valley (Swanton 1922). During the next 50 years, British encroachment on the Cherokee's eastern border, French movement along the Chickasaw's southern and western boundaries, and Spanish designs on the Creeks in Florida forced the tribes, initially, to respond with hostilities, and then gradually yield ground to the

military superiority of the Europeans (Smith 1979; Perisco 1979; Swanton 1922; Gibson 1971). Between 1700 and 1755, the Cherokee responded to their losses in the east by pushing down the Tennessee River. This action brought them into direct contact with the Creek, resulting in a protracted war which culminated with a decisive Cherokee victory at Taliwa in 1755. After their defeat, the Creeks withdrew from the Tennessee Valley and the Cherokee continued to expand down the river.

At the other end of the Tennessee, the Chickasaw were locked in a life-or-death struggle with the French. Believing the Chickasaw were promoting British interests in the Mississippi Valley, the French mounted several campaigns designed to eliminate them. Though they defeated the French in 1736 and fought them to a draw in 1740, the Chickasaw were succumbing to the effects of war and disease. Rather than living in the fortified towns at the mouth of Elk River, constantly under the fear of attack, several Chickasaw bands decided to settle the more peaceful reaches of the middle Tennessee River.

In 1764, the Chickasaw established a settlement on Hobb's Island, about five miles east of Triana. It was at this juncture that the Chickasaw ascent and the Cherokee descent of the river collided. The ensuing war lasted until 1769, when the Chickasaw scored a decisive victory at Chickasaw Old Fields (Swanton 1922:179).

Substantially weakened from the war, both tribes retreated to more secure positions, leaving the middle reaches of the Tennessee virtually abandoned. The relative position of the two tribes was codified in 1786 when official relations between the United States and native Indian tribes opened with the Treaty of Hopewell. The boundary (which is marked on the Farley and Huntsville 7.5' quadrangle sheets) between the two tribes was recognized as an indefinite line which ran through present-day Madison County, even though neither tribe had nearby settlements (Alexander 1979). This situation lasted until 1805, after which both tribes lost their native lands in a succession of treaties. The series of land cessions (Figure 4) culminated for the Chickasaw in 1832 and the Cherokee in 1835, at which time they were removed to areas in Oklahoma and Texas.

Traditionally, due to its position as a buffer separating the Chickasaw, Cherokee, and Creek nations, the middle reaches of the Tennessee River Valley were reserved as hunting grounds traversed by small transitory bands. European settlement shifted the balance of power; and with it, forced the tribes into the disputed zone. Different groups followed various courses, some tribes joining together; others being absorbed into their more powerful neighbors; and others simply fighting each other. Understanding why similar tribes chose widely disparate courses of action is extremely difficult. The confused and constantly changing state of affairs presented each tribe with a variety of alternative actions, none of which ultimately allowed them to adapt to the European presence.

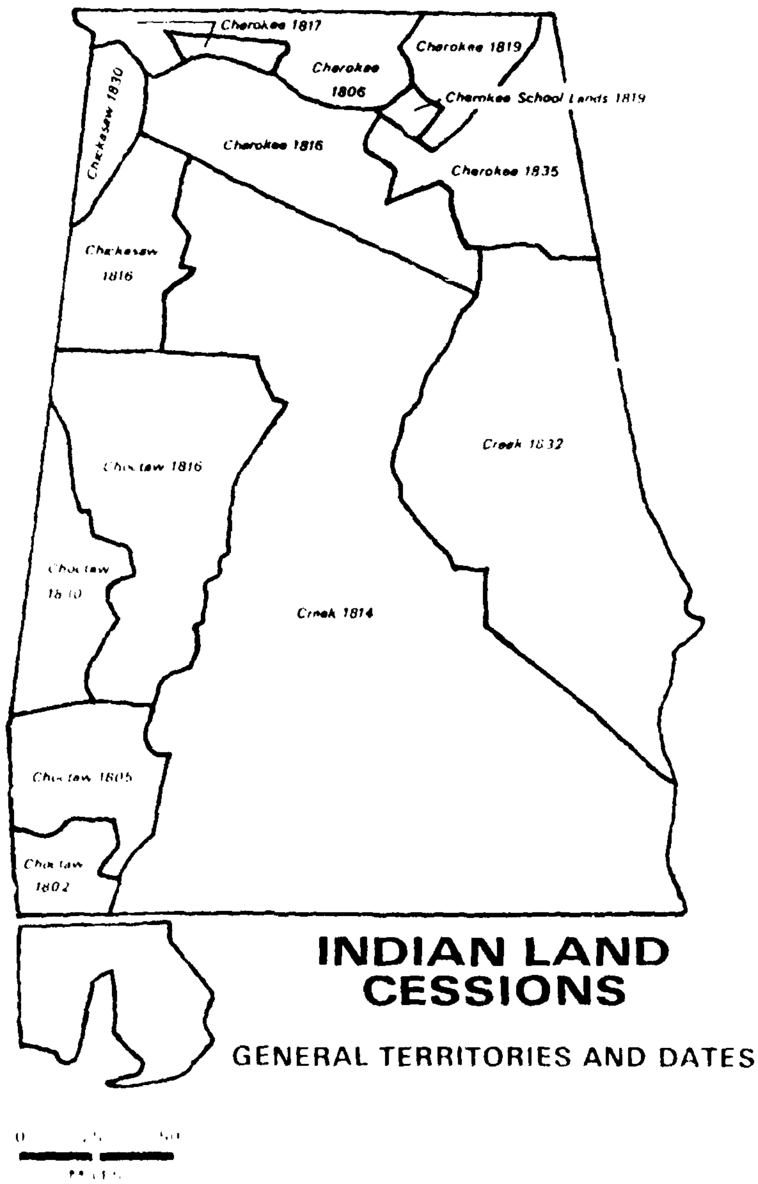

FIGURE 4. LAND CESSIONS OF THE CHOCTAW, CREEK AND CHICKASAW

4. HISTORY OF MADISON COUNTY, ALABAMA, HUNTSVILLE, AND THE REDSTONE ARSENAL

By

Jeffrey H. Altschul

Madison County and Huntsville

Historical Development

Prior to the American Revolution, three European and two Indian nations claimed the area encompassed by present-day Madison County. The earliest European claim was entered by Spain in 1493. But the Spanish never settled the area and their rights, which were never paid more than lip-service, gradually diminished until relinquished in 1740. English claims were issued in 1497, though it was not until near the end of the seventeenth century that the fur trade led the British to take an active role in pacifying the area. France had similar designs on controlling the natural wealth of the Mississippi Valley and in 1524 decided to stake its own claim to the Tennessee Valley. Control of the area remained disputed until 1763 when France lost the Seven Years War and relinquished its rights to areas east of the Mississippi River. In turn, after the American Revolution in 1783, England ceded its claims to the United States.

While the major colonial powers disputed and fought over the area, several smaller groups assumed control of various sections. In 1733, Georgia claimed the territory west of the Savannah River as its own colony, and then in 1789, sold the region to the Yazoo Land Company. Six years earlier the Cherokees had sold portions of the same land to the William Blunt Company. Confusion over property rights persisted until 1802 when the entire Mississippi territory which encompassed Alabama was ceded to the United States. The federal government quickly codified Indian boundaries, recognizing the Chickasaw's rights to areas west and the Cherokee's to lands east of an indefinite line running through present-day Madison County (Alexander 1979). The Indian rights to these lands were soon extinguished through purchases and treaties in 1805 and 1806. In the wake of these actions, a triangular area of 345,600 acres was opened for settlement and on December 13, 1808, was formally established as Madison County.

The swift moves to control Indian lands and to incorporate Madison County into the Mississippi territory were precipitated by increasing numbers of illegal squatters. Perhaps the first white settler in the county was John ("Old Man") Ditto who established Ditto's Landing on the Tennessee River to ferry pioneers between Chattanooga and Colbert's Ferry. Although Ditto's name does not appear on the 1809 county census, it is likely he remained in the area, taking up residence among the Cherokees to avoid government officials.

About the same time Ditto's Landing was established, Joseph and Isaac Criner, together with Stephen McBroom, moved into the county from Tennessee and built a cabin at Mountain Fork on Flint River. Shortly after the cabin was completed, John Hunt and a man named Bean arrived searching for the "Big Springs", an area ideal for settlement, described in various Indian legends. Hunt, after whom Huntsville was ultimately named, and Bean returned to Criner's cabin around 1809, reporting that Bean was returning to Tennessee but that Hunt was going to settle the "Big Spring" area located at present-day Huntsville.

Hunt and Ditto were the forerunners of a large number of unauthorized squatters, mainly of Scottish or English descent, who settled various tracts of the county before the government could arrange official land sales. The majority of the settlers were located along the Tennessee River, between the Flint River and present-day Triana, and had arrived in the area primarily from Tennessee, and the mountain sections of Virginia, North Carolina, and South Carolina (Hoole and Hoole n.d.). The settlement of Huntsville was still in its infant stages of growth, therefore the orientation of the settlers was toward Nashville, as the closest and most accessible commercial center. A well-travelled roadway, complete with roadside taverns and rest stops, was established between the Tennessee River and Nashville. The southern terminus of the road was the small settlement of Whitesburg, and the road was locally referred to as the Whitesburg Pike (Hoole and Hoole n.d.:27). The settlement grew with the increasing population of the Madison County area, and by 1808, it was well known enough to serve as one of the landmarks utilized in the legal description of the county (Brewer 1975:346). The settlement is of special interest with regard to the project for it lies just off the southeast boundary of the study corridor (Figure 5).

Although the settlements of Whitesburg and Huntsville continued to grow, settlement of the surrounding region was haphazard and uncontrolled, with so-called "squatter's rights" taking precedent. By January 1, 1809, the situation had deteriorated to the point that further settlement in the county was prohibited. President Madison, for whom the county was named, ordered a complete census to identify established claims and quickly moved to facilitate legal settlement of the area. On April 1, 1809, the President ordered the sale of land in the territory acquired from the Indians, and five months later in Nashville, the sales were finalized.

The Nashville land sales altered the course of history in Madison County. Rather than pioneer frontiersmen, the purchasers of land were well-established gentry families of Virginia, South Carolina, and Georgia. These families fundamentally changed the social structure and economy of the region, shifting from subsistence oriented farms to large cotton plantations run on slave labor. Members of these families were quick to take charge of all civic offices and public affairs.

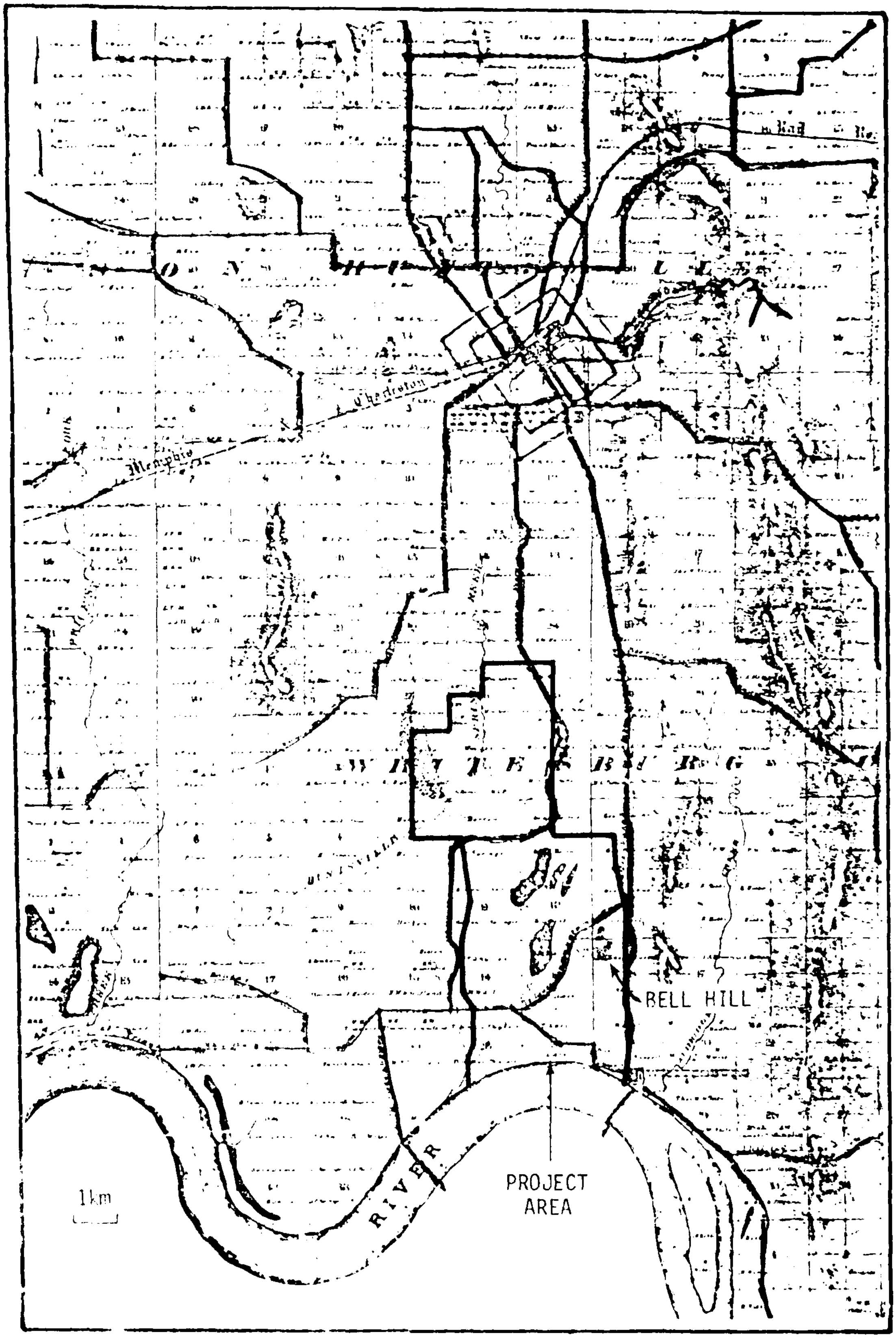

FIGURE 5. 1875 MAP OF MADISON COUNTY SHOWING LOCATION OF THE PROJECT AREA. Note that four lakes are shown in the center of the project area, west and northwest of Bell Hill.

One of the most influential new owners was Leroy Pope, originally from the Broad River area of Georgia. Pope, with unusual foresight, quickly bought 1000 acres near the Big Spring from Matin Beatty for $23.00 per acre. Pope, knowing that a commission had been set up by the legislature of the Mississippi Territory to locate a county seat, donated a portion of this land for a town square and then sold the town the rest for about $25.00 per acre. Pope remained extremely active in developing the town, planning its streets, presiding over its first court, and building its first mansion. He was also instrumental in naming the community Twickenham after the residence of his favorite poet, Englishman Alexander Pope.

The name Twickenham lasted barely three years. By 1810, anti-British sentiment began to emerge, as well as a feeling that the town should be renamed after its original settler, John Hunt. On November 25, 1811, popular sentiment won out and the town's name was changed to Huntsville.

Between 1810 and 1819, Huntsville became a thriving commercial and social center. The county's population increased rapidly and in 1811, President Madison ordered the land office moved from Nashville to Huntsville. Two newspapers, the Madison Gazette and the Huntsville Republican (changed to the Alabama Republican in 1818) were established. The Green Academy opened in 1813, becoming the first school in Alabama to be subsidized with public money. Alabama's first bank, the Planters and Mechanics Bank of Huntsville, was chartered in 1818. Huntsville became a center for a variety of religious faiths with the Methodists and Presbyterians establishing churches in the town by 1820.

Perhaps the best description of Huntsville during this period was made by Anne Royall in 1817.

> The land around Huntsville, and the whole of Madison County...is rich and beautiful as you can imagine, and the appearance of wealth would baffle belief. The town stands on elevated ground, and enjoys a beautiful prospect. There is a large square in the center of town... and facing this all the stores, twelve in number. These buildings form a solid wall though divided into apartments. The workmanship is the best I have seen in all the states, and several of the houses are three stories high and very large. There is no church. The people assemble in the Court House to worship. Huntsville is settled by people mostly from Georgia and the Carolinas ---though there are a few from almost every part of the world---and the town displays much activity (Royall 1969:119).

Between 1813 and 1819, three notable events occurred in Huntsville. On October 11, 1813, General Andrew Jackson and his army

camped in Huntsville (Figure 6) on the way to their decisive victory at Horseshoe Bend during the Creek War. While in Huntsville, Jackson recruited four companies including the "Mounted Rangers" under the command of Captain Eli Hammond (Brantley 1976). In June 1819, Huntsville received an unexpected visit from the President of the United States, James Monroe, who was traveling through the western section of the country.

Scarcely a month after President Monroe's visit, Huntsville hosted the constitutional convention which drafted Alabama's state constitution, elected its governor, and selected the state's first United States Senators and federal judges. Several members from Huntsville were instrumental in gaining Alabama's statehood. John W. Walker, a prominent local lawyer, was president of the constitutional convention and was selected to be one of the state's first senators. Clement C. Clay prepared the draft containing the main features of the constitution, which was adopted by the convention with only minor changes. On December 4, 1819, Alabama received statehood, with Huntsville recognized as its capital until construction of more appropriate state buildings could be completed in the designated city, Cahaba.

Huntsville's growth was greatly facilitated in the 1820s when transportation and communication became much faster and less expensive. In the early part of the decade, a stage depot was established; and as cotton became more profitable, it was decided to build a canal connecting Huntsville with Triana, a small port on the Tennessee River. The canal was opened to flatboats in 1827, and business in Triana boomed. But by 1860, railroads connected Huntsville more directly with most major markets and water transport centered at Triana died out (Harris 1976).

Between 1820 and 1860, Madison County emerged as a major center of cotton production. By 1860, over 250,000 bales of cotton were shipped out of the county annually (Dodd 1974). In this region, cotton implied slavery, and by the start of the Civil War, between 50 and 85 per cent of all white families in the county owned at least one slave. Even though slavery was widely accepted, over 70 per cent of the residents of the county voted against seceding from the Union in 1861. Yet, when war broke out, Madison County solidly supported the Confederacy.

Huntsville suffered severely during the war because of its importance as a Confederate supply depot and railroad terminus. Union Brigadier General O. M. Mitchell surprised the city early on April 11, 1862, capturing about 200 soldiers and 15 locomotives. Of his success, Mitchell wrote, "We have at length succeeded in cutting the great artery of railway intercommunication between the Southern States" (quoted in Griffith 1968:391). But success was transitory for both sides with the Confederacy recapturing the railroad the following autumn, only to lose it again in July 1863.

After occupying the city for nearly five months the Union Army evacuated Huntsville on August 31, 1862, leaving behind 90 wounded soldiers and taking about 1500 local negroes. Without their slaves, local farmers were ill-equipped to support the county, much less the Confederacy. The situation reached crisis proportions the following year as the Union Armies reoccupied Huntsville in quick succession on July 13, July 24, and August 11, 1863. During this period, the Methodist Church and the Huntsville Female College were requisitioned by the Federal Army for use as hospitals and barracks.

After 1863, Huntsville was spared further degradation; and with the exception of General Benjamin Gierson's raid on Triana in 1864, the remainder of the Civil War passed quietly in Madison County. Though in comparison to other areas, Madison County went relatively unscathed, the defeat of the Confederacy was devastating to the local economy. As noted above, in 1860, the county produced over 250,000 bales of cotton annually. By 1878, cotton production had dropped to around 25,000 bales yearly. Production began to increase in the later parts of the nineteenth and early twentieth centuries; but had it not been for the catastrophic effects of the boll weevil in Southern Alabama during the 1920s, it is doubtful that the industry would have returned to pre-Civil War production levels. The boll weevil blight to the south led to renewed investment in the area; and by 1930, the Tennessee Valley emerged as the leading cotton-producing area of the state, a position the region still enjoys today (Dodd 1974).

While cotton has remained an important economic force, the most dramatic changes in Madison County have occurred in the last 30 years in response to nonagricultural industries. Between 1860 and 1950, the population of the county was relatively stable, growing at less than two per cent per year. Most of these people lived in rural settlements (Figures 5 and 7); and no more than 30 per cent of the population lived in Huntsville, the only town with more than 2500 inhabitants. Since 1950, Madison County has more than tripled in population, the vast majority of this increase being absorbed in Huntsville, which has grown from a modestly sized community to the fourth largest city in the state.

Land-Use Patterns

Madison County has long been one of the most agriculturally productive counties in Alabama. Except for the mountainous section along the eastern border, most of the county is open farmland with over 80 percent of its soils suitable for crops. Given its natural endowment, it is not surprising that Madison County was one of the first areas in Alabama developed agriculturally. Much of the early agricultural expansion took place in the nineteenth century when most farmland in Alabama was still either in woodland or forest. The development of Madison County outpaced nearly every other region of the state, and by 1860, Madison was the only county in northern Alabama, and one of six in the entire state, which tilled over 45 per cent of its farmland (Lineback 1973). Though agricultural production

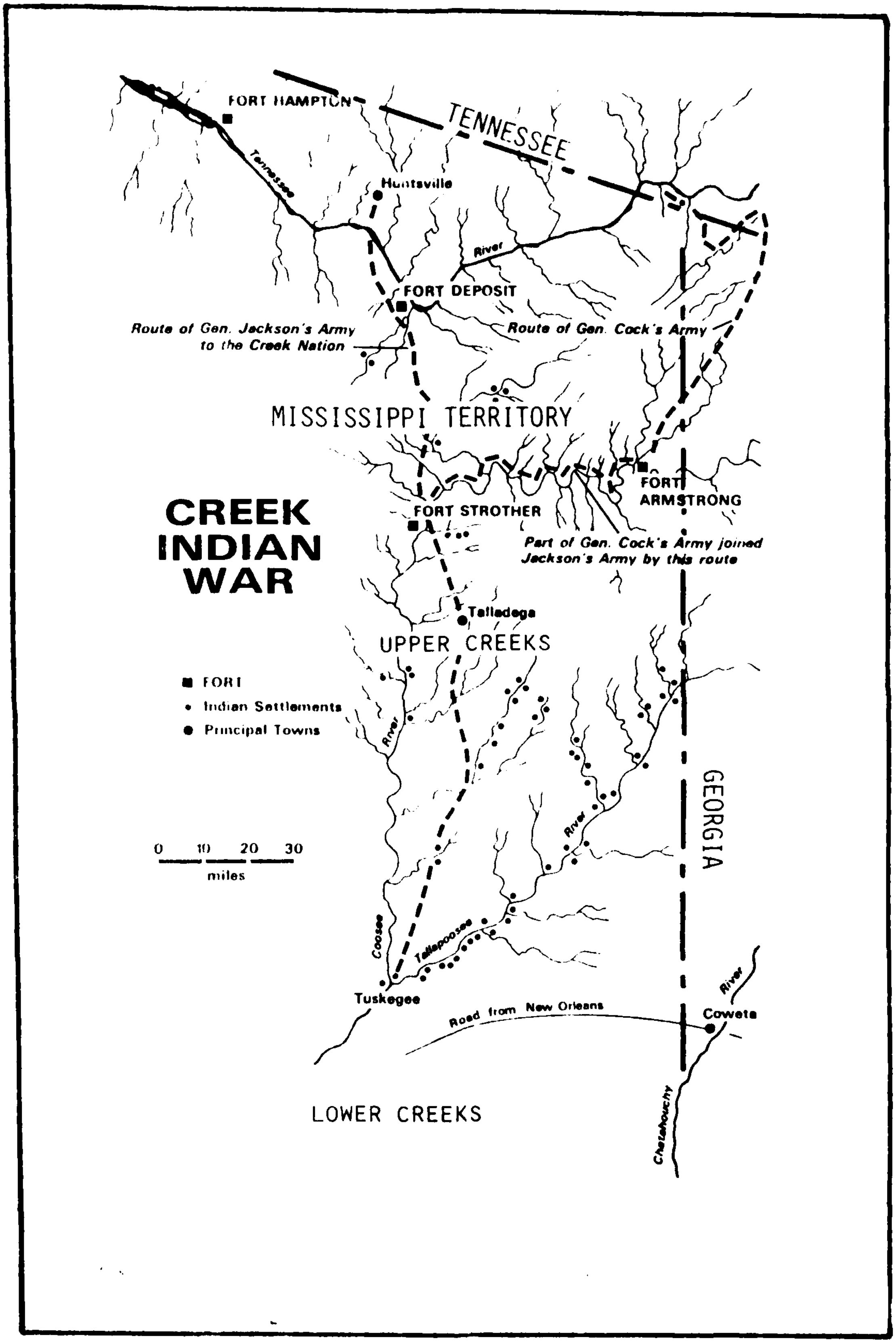

FIGURE 6. ROUTE OF GENERAL JACKSON'S ARMY TO THE CREEK NATION

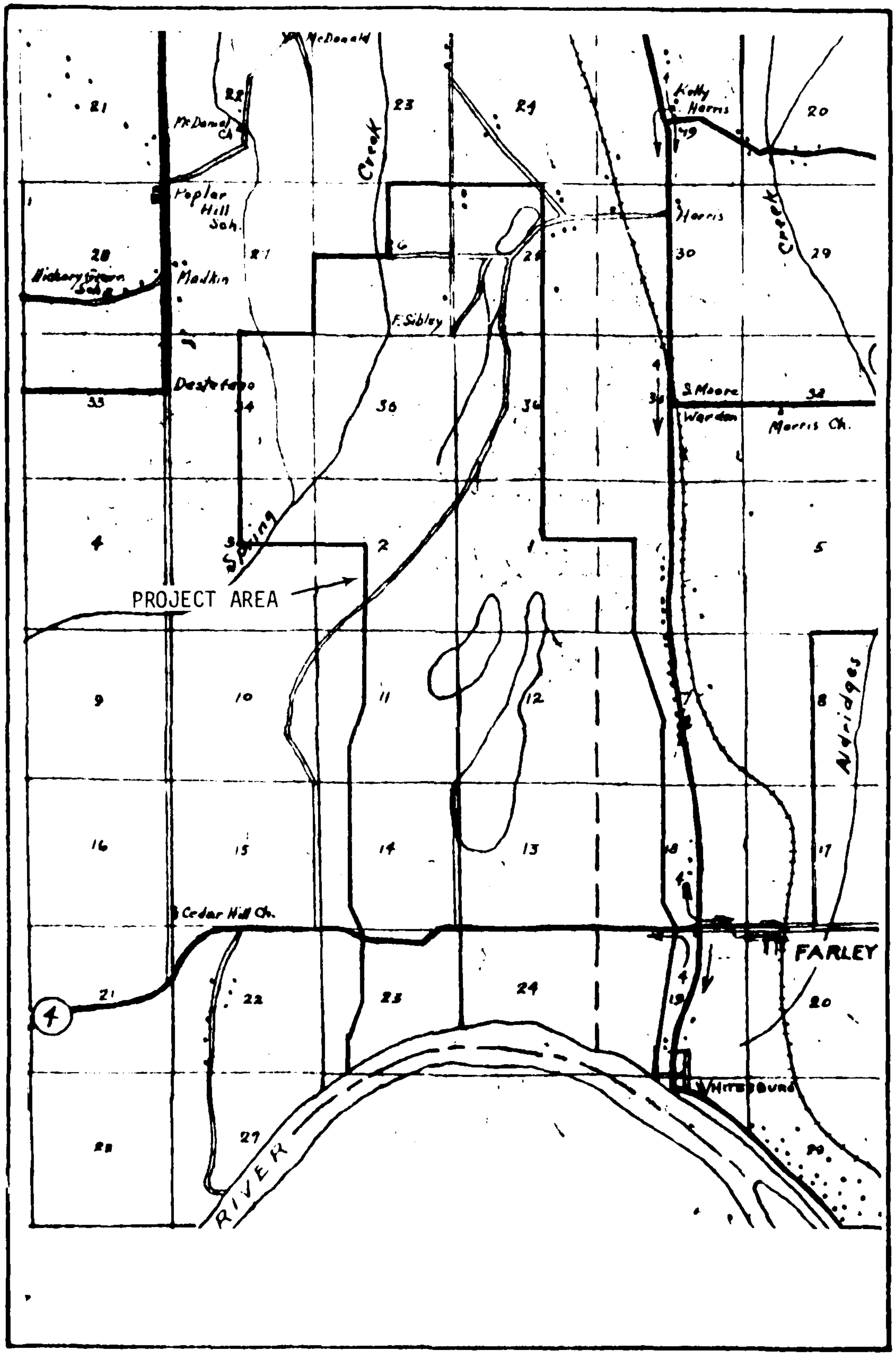

FIGURE 7. 1934 RURAL DELIVERY ROUTE MAP OF MADISON COUNTY SHOWING LOCATION OF PROJECT AREA. Note that two lakes are shown in the center of the project area west and northwest of Bell Hill.

declined following the Civil War, by 1930, Madison County was once again a leading agricultural center being one of six counties in Alabama with over 60 percent tilled farmland.

Since 1930, the amount of land devoted to agricultural production has remained fairly steady, about 80 per cent of the county's land. Though acreage has remained nearly constant, the size of individual holdings has nearly tripled. In 1950, the size of the average farm was 83.4 acres; while less than 20 years later, the average holding was between 200 and 300 acres (Soil Conservation Service 1958; Lineback 1973). Much of this consolidation has taken place at the expense of the tenant farmers, who in 1950 worked over half the farms (2759 out of 5004) in Madison County.

Traditionally, cotton and corn have been the major crops. Prior to the Civil War, the county was one of Alabama's leading cotton producers, however, the loss of slavery had a devastating effect on the industry. Much of the land previously reserved for cotton was put into corn; and by 1919, acreage was divided evenly between the two crops. The boll weevil blight devastated cotton fields in southern Alabama during the 1920s leading to a renewed interest in the industry in the Tennessee Valley. By 1929, cotton acreage dominated corn fields by a two to one margin in Madison County alone (Soil Conservation Service 1958). Though this margin has fluctuated widely over the years, cotton has remained the dominant crop with well over 100,000 acres planted annually.

In the last several decades, crop diversification has led to major changes in the agricultural output of the county. Soybeans are the present "glamour crop" of Alabama, and the farmers of Madison County have invested heavily in the crop with returns of over 1.5 million dollars in 1970 alone (Lineback 1973). Grain sorghum, grown for livestock feed, has become another important cultigen while several hay crops, principally alfalfa and lespedeza, have been grown extensively in recent years.

Redstone Arsenal

Historical Developments

Huntsville's growth and the diversification of Madison County's economy are both directly related to the history of the Redstone Arsenal. Originally designated the Huntsville Arsenal, the military reservation was purchased from 320 landowners by the U.S. Department of the Army for the Chemical Warfare Service in 1941. The base was to provide facilities capable of supplying an army of 2.8 million men with necessary chemical munitions. The total area purchased was 31,998 acres, to which an additional 6990 acres were later included under a land agreement with the Tennessee Valley Authority (Joiner 1966:132). Initially, the Arsenal was to contain 11 manufacturing plants, four chemical-loading plants, plant storage, laboratories,

shops, offices, a hospital, fire and police protection, and a communication system including roads and railroads. Though impressive in its own right, successive authorizations expanded the original plans resulting in a nearly self-sufficient city. Upon completion in 1943, the Huntsville Arsenal was the largest chemical warfare plant in the world.

Besides the Huntsville Arsenal, two additional military installations were included in the reservation, though under different command. The Gulf Chemical Warfare Depot was constructed on the southernmost 7,756 acres bordering the Tennessee River. This depot was designed to receive, store, and ship all types of Chemical Warfare Service (CWS) materials. By 1943, the depot maintained seven warehouses, 370 concrete storage igloos, 55 above-ground magazines, and many outdoor storage facilities for various types of bombs and chemicals (Joiner 1966).

The second installation was built by the Ordnance Department in the later part of 1941 and 1942, and was located approximately 10 miles south of Huntsville on 4000 acres of the Arsenal. Termed the Redstone Ordnance Plant because of a preponderance of red soil in the area, the complex was established to load and assemble 75mm chemical shells and their burster charges. Included in the layout of the plant were two burster- and shell-loading and assembly lines, 24 inert storage warehouses, 30 concrete igloos, 35 finished ammunition magazines, and administrative and utility buildings. On the eve of World War II, the plant was reorganized and renamed the Redstone Arsenal.

During the course of the war, both the Huntsville and Redstone Arsenals worked round the clock, seven days a week. At the Huntsville Arsenal, all types of chemical munitions were produced including mustard gas, lewisite, phosgene, white phosphorus, white smoke munitions, tear gas, and incendiaries. In turn, the neighboring Redstone facilities received these chemicals and produced the appropriate bombs or shells. The relationship between the arsenals worked extremely well. But with the end of the war, the need for such large chemical warfare plants was drastically reduced. Both arsenals were deactivated, cleaned up, and phased out of active service. The plants manufacturing chlorine, thionyl chloride, and white phosphorus were leased to private firms while over 12,000 acres were rented to farmers. In 1949, the Huntsville Arsenal was put up for sale.

In June, 1950, the Ordnance Department reactivated Redstone Arsenal to carry out research and development in the field of rocketry (Joiner and Jolliff 1969). Plans were drawn up immediately to relocate existing research into the extant buildings at the Arsenal. While these arrangements were being completed the Ordnance Department became caretaker of the entire Huntsville Arsenal, pending final disposition of the land. With nearly 40,000 acres at their disposal, the Army approved the transfer of the Ordnance Research and Development Division, Sub-office, rocket, from Fort Bliss, Texas, to Redstone.

The Fort Bliss group included 120 German scientists and technicians granted asylum and immunity from prosecution as war criminals under "Operation Paperclip" during 1945 and 1946. Led by Dr. Wernher Von Braun, the group was to conduct basic and applied research, develop and test free rockets, guided missles, and solid propellants. During the years betwen 1950 and 1958, many of the basic precepts of rocketry were established, while simultaneously, the first sophisticated surface-to-surface and surface-to-air rockets were developed. Research, however, was not limited to conventional rockets. Primary research was conducted on long-range missiles to be used against ground targets and high-altitude aircraft, culminating in the Hermes, Redstone, and Nike projects. In response to a growing need for trained personnel throughout the free world, the Ordnance Guided Missile School was established at Redstone in 1952.

In 1956, the history of Redstone, as well as the rocketry field itself, was fundamentally altered with the establishment of the Army Ballistic Missile Agency (ABMA). Originally chartered to produce the first intermediate range ballistic missile, the ABMA took over the responsibility of the Redstone, Jupiter, and ultimately the Pershing missile programs. Shortly after the Soviet Union launched the first satellite, Sputnik I, on October 4, 1957, the Secretary of the Army submitted a proposal to the Secretary of Defense outlining the Army's existing capability to launch a satellite. This ability rested on a Jupiter C vehicle consisting of an elongated Redstone booster as a first stage and a cluster arrangement of scaled-down Sergeant rockets as the second and third stages (Bullard 1965). The ABMA's responsibility over these missile projects led to its involvement in the development of the United States' first satellite, Explorer I, launched January 31, 1958.

Several months after the successful launching of Explorer I, the Army reorganized its missile program. Instead of a variety of overlapping and often competing agencies, all projects were brought under the control of the Army Ordnance Missile Command (AOMC) headquartered at Redstone Arsenal. By 1960, many of the components of AOMC had been shifted to the control of the National Aeronautic and Space Administration (NASA). At Redstone, NASA build a new flight center on 1800 acres. The George C. Marshall Space Flight Center was formally opened July 1, 1960, at which time Major General August Schomberg, Commanding General, AOMC, transferred the missions, personnel, and facilities of Redstone to Dr. Wernher Von Braun, Director of the new center (U. S. Army n.d.). In the last 20 years, members of the flight center have been involved in almost every major space program from Apollo to Skylab. Throughout its entire history, the Redstone Arsenal has been in the forefront of military and space technology ensuring its place as one of our country's major cultural resources.

Land-Use Patterns

Prior to its acquisition, the land of the Redstone Arsenal had been cultivated for over 100 years. Most of the land had been farmed

in cotton, corn, hays, and small grains with sections also used for pasture. Judging from the location and size of the 45 listed non-Afro-American cemeteries, within the Arsenal, consisting largely of small familial plots, the farms were rather restricted in size (Johnson 1971).

While most of these farms were probably small, family-operated units, there were two antebellum plantations located in the Arsenal. The Goddard house (Plate 3), a two-story structure, was located originally in an isolated section of the northern part of the Arsenal. During the 1950s, the house was moved to its present location, where it is maintained as a guest house by the Army. The Lee-Cooper-Fennel home was originally purchased by James Cooper in 1818, who placed the two-story brick house in the southern section of the Arsenal. Cooper probably had the house built in Chattanooga and then shipped downriver (Alexander 1979). Shortly thereafter, Cooper became increasingly despondent and commited suicide in 1834 by placing an iron pot over his head and diving into the Tennessee River. His widow, Charity Cooper remarried in 1840 to Mr. Houston L. Lee, who immediately added a circular walnut stairway to the house. Lee died in 1853, and Charity, unable to meet the debts, had the house sold in a sheriff's sale in 1867. The house was bought for $7745.97 by the Fennels, who kept the structure until the inception of the Arsenal in 1941. During World War II, the Gulf Chemical Warfare Depot used the house as its headquarters. Desperately in need of repair, the house was sold back to relatives of the original owners, who relocated the house outside the Arsenal in 1975.

Since 1941, the landscape of the Arsenal has changed dramatically, reflecting its varied military uses. At peak production during the war, there were over 300 structures devoted to the production and storage of chemical munitions. Except for the Incendiary Bomb Filling Plant, the original structures of the Huntsville Arsenal were laid out in an area approximately two miles southwest of Madkin Mountain in a systematic and orderly design; later wartime construction was located in a new area two miles south of Madkin Mountain in an irregular pattern. The Incendiary Bomb Filling Plant was situated on the eastern slopes of Madkin Mountain near the south end. Eight acres on the right bank of Huntsville Spring Branch, known as the "boneyard", were set aside for decontamination of metal articles contaminated with mustard gas or lewisite (though decontamination of the latter material was not altogether successful).

Construction at the Redstone Arsenal and Gulf Chemical Warfare Depot was much less extensive. The latter consisted of storage facilities confined to a small area near the Tennessee River. Redstone facilities, which largely produced shells and chemical munitions, were concentrated in a 4000 acre area 10 miles south of Huntsville. Prior to construction, the rolling terrain was entirely used for cotton, peanuts, and livestock production. No permanent roads existed, and power and water had to be tapped from the Huntsville Arsenal utilities.

PLATE 3 . THE COMPLETELY RESTORED GODDARD HOUSE. NOTE THE BRICK OVERLAY WHICH REPLACED THE ORIGINAL CLAPBOARD SIDING (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

In the wake of the war, many of these structures were permanently sealed and portions of the land allowed to return to cultivation. The emergence of Redstone as a major center of rocketry research and development during the 1950s led to renovation and new construction. This course culminated in 1960 with the construction of the George C. Marshall Space Flight Center, consisting of three multi-storied office buildings surrounded by several huge laboratories and test stands. Military construction continues at Redstone, and the resulting picture illustrates the varied uses the installation has been put to for nearly three decades.

Goddard House: Introduction and Setting

The Goddard House, moved to its present location in December, 1955, is situated approximately 1.5 miles (.9 kilometers) west of Gate Three, within the Redstone Arsenal complex. Positioned on a low knoll, the house commands a view of the southeastern section of the Arsenal. The grounds have been landscaped through the years since the movement of the structure, and extensive rose gardens and tulip beds form the dominant ornamentals used (Redstone Rocket 17 February 1971).

Historical Background: The land on which the Goddard House was originally built was initially owned by James Manning and William Thompson, who purchased portions of the property at various times between 1809 and 1828 (Abstract of Title 1931). Sometime after 1828, but prior to 1836, James P. Mathews purchased portions of the property from the two men, and, by 1835, had built the structure now referred to as the Goddard House. The actual history of the construction of the building is unknown; however, the architectural style of the house, a well-executed Roman Classic motif (Blumenson 1977:23), is typical of the finer homes constructed between about 1790 and 1830 throughout the eastern and southeastern portions of the country. The siding of the original structure was clapboard; however, the most distinguishing characteristics were Roman Doric columns forming the entrance to the portico (front porch). The house form deviated from the Roman Classic motif in that the portico roof is completely horizontal, and lacks the lunette and pediment (Plate 3), thereby resulting in a stronger, cleaner line, more typical of antebellum houses influenced by the Greek Revival architectural style popular from 1820 to the Civil War (Blumenson 1977:27).

Mathews sold the property to the Davis family in 1892 for $14,000 (Abstract of Title 1931). The property holdings included not only the Mathews' House, but also some 700 acres. The Davis family retained title to the property until 1924. In the years intervening between the initial Davis purchase and the sale in 1924, approximately 20 acres of land had been sold. In 1924, the 680 acres and the house were purchased by M.G. Chaney for $34,000, and Chaney retained title to the purchase until it was sold to the government in 1941. Approximately 675 acres were involved in the final purchase, and in the final transfer, confirmation title fees of $675.75 were paid to the Chaneys.

The use of the house from 1941 until its removal from the Chaney property to its present location is somewhat ill-defined. In an account of the moving of the house in the 3 January, 1956 Redstone Rocket, the house is listed as being used as a storage facility for electrical supplies. In 1942, it became a residence for Arsenal personnel until it was closed in 1953 because of its "remote" location and lack of proper water supplies.

The determination to move the house was made in 1955, when it became apparent that billeting was necessary close to the Post Headquarters to handle the increasing number of visitors to the Arsenal involved in the developing space program. The house was physically moved by a Nashville contracting firm, and the entire process of transporting the house the eleven miles from its original location to its new site took two days (Plate 4). Renovation of the house in order to accommodate six to eight visitors was conducted by the Post Engineers' Office, and was, essentially, completed by February of 1956. The clapboard exterior was replaced by yellow brick; however, the exterior design was left essentially intact. Major renovation was conducted on the house interior, and involved replumbing, the updating of the kitchen facilities, the addition of air-conditioning, and telephones. The house was formally opened in February, and designated the Goddard House after one of the principal pioneers in rocket technology, Robert Hutchings Goddard.

The interior renovations to the house did not impair the basic floor plan or components. An examination of Arsenal supplied photographs indicates that the staircase, first floor fireplace and molding, baseboards, door moldings, and possibly the floors appear to be the originals. The addition of a basement, brick facade to replace the original clapboard exterior, and fire escapes has, however detracted from the integrity of the structure. In addition, the fact that the house was moved from its original location would be of concern in the evaluation of the structure for inclusion into the National Register of Historic Places. Although it is certainly possible to nominate the Goddard House to the National Register on the basis of its age and representativeness as an example of antebellum architecture within the region, the exterior alterations, and certain of the interior modifications, such as the basement addition, possibly do not meet the criteria for inclusion onto the Register. The structure should, however, be nominated.

Standing Military Structures

The standing military structures in non-classified areas of Redstone Arsenal were assessed in terms of their potential for inclusion, at some future date, into the National Register of Historic Places. One structure on the base has already been designated as significant, the original Redstone Rocket test stand (Plate 5). The historical significance, in terms of the development of both rocket and space technology, of the test stand, cannot be evaluated too highly; however, with the possible exception of other, similar,

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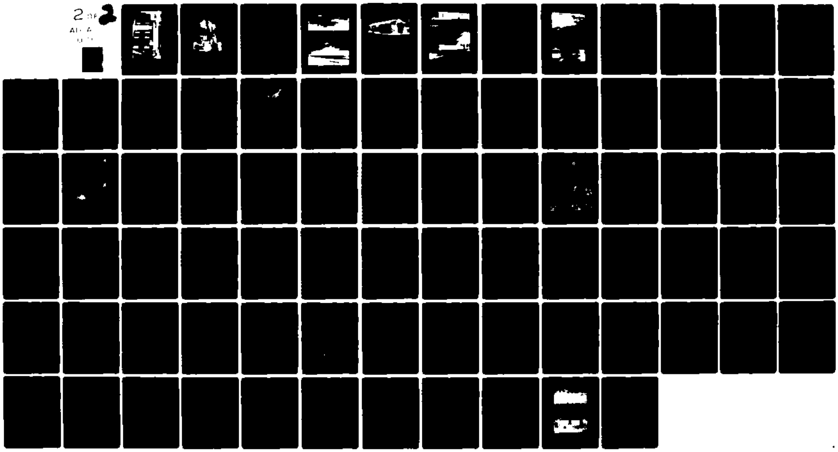

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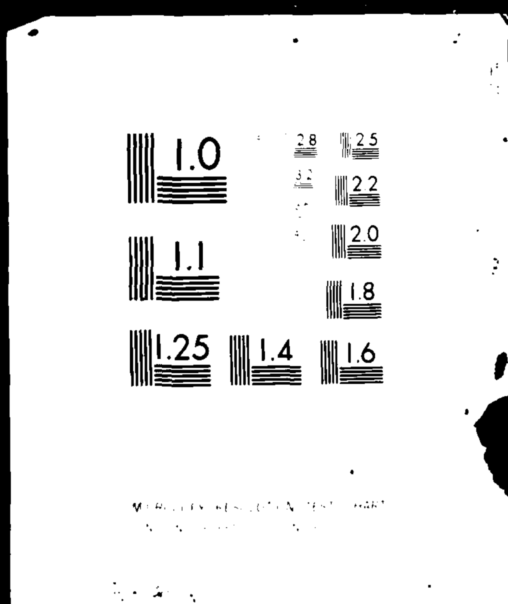


PLATE 4 . THE MOVING OF THE GODDARD HOUSE TO ITS PRESENT LOCATION IN 1955. THE PORTICO AND COLUMNS WERE MOVED SEPARATELY FOLLOWING DISMANTLING (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

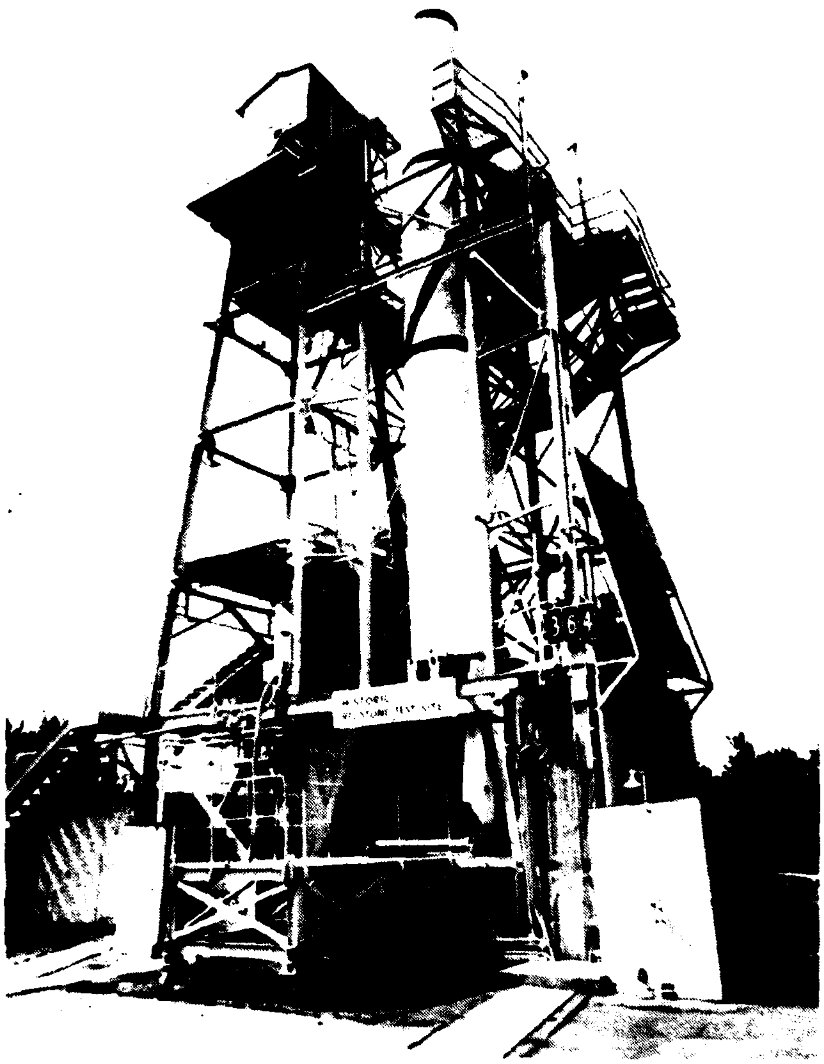


PLATE 5 . THE HISTORIC REDSTONE ROCKET TEST SITE (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

structures involved in the development of various rocket or fuel types, the remainder of the buildings on Redstone Arsenal are examples of functional military architecture common to military establishments throughout this country. A brief resume of the various architectural styles will be made, as they do indicate changes in styles over the last forty-year period.

The base development began in 1941, following the purchase of several thousand acres of land by the United States government. At the time of purchase, several dozen dwellings and associated farm structures and commercial buildings were present, the majority of which were razed within the next ten years. With the exception of such buildings as Goddard House and the Fennel House, which were used for various purposes, the majority of the buildings were not secure enough, nor did they have the proper facilities, for military use.

The building program consisted of the construction of primarily wooden frame, clapboard structures, to be used as barracks (Plate 6), support facilities (such as the fire station illustrated in Plate 7), and office quarters (such as building S-7145, Plate 8). Concrete-constructed buildings were also formalized during the initial building program, primarily as bunkers and munitions storage locations. As many of the buildings were considered temporary structures to accommodate the rise in base population during the World War II years, their basic composition was not geared to long-term use.

The partial deactivation of the base in 1945 obviated the necessity to replace the buildings; however, by the full reactivation of the base in 1950, building schedules were, once more, given priority. Over the next twenty-year period, the majority of newly constructed buildings on base were of red (fire) brick or slump-block construction (Plates 9 and 10), although wooden frame buildings, dating to the first building stage, were renovated, and new wooden structures built. The majority of buildings identified in non-restricted areas of the base date to these two building stages. However, it must be remembered that, in 1960, the George C. Marshall Space Flight Center, composed of a nine-story office building and two six-story research and office buildings, plus extensive laboratory and test facilities, was formally dedicated, occupying some 1,800 acres within the boundaries of Redstone Arsenal. The architectural style of the complex is, perhaps, best described as "office modern"; however, the importance, in terms of space technology and research, of the efforts initiated and conducted at the center, far outweighs the lack of architectural flair apparent in the center's buildings. Despite the importance, however, of the research conducted over the forty years of the Arsenal's history, none of its buildings could be judged potentially significant in terms of the identification of architectural innovation or uniqueness.

PLATE 6. WOODEN FRAME BARRACKS REPRESENTATIVE OF THE FIRST BUILDING STAGE AT REDSTONE ARSENAL (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

PLATE 7. WOODEN FRAME FIRE STATION BUILD IN 1941 AS PART OF THE FIRST BUILDING STAGE AT REDSTONE ARSENAL (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

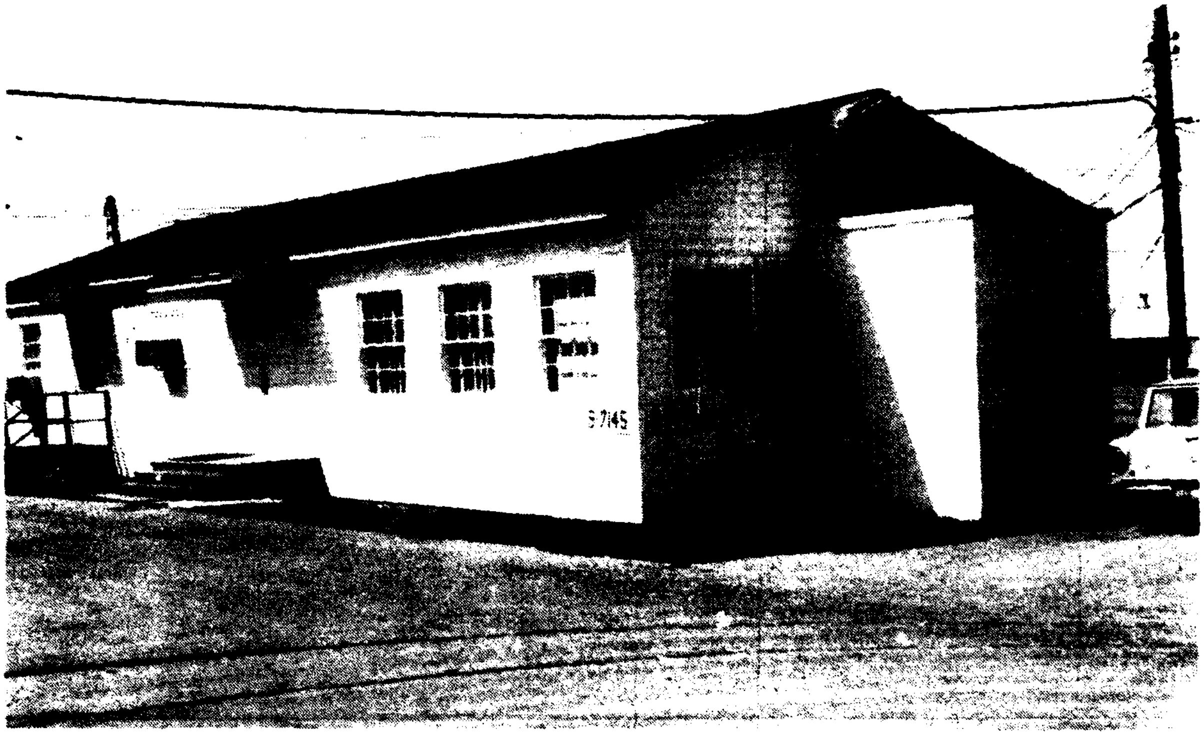


PLATE 8. WOODEN FRAME OFFICE STRUCTURE REPRESENTATIVE OF THE FIRST BUILDING STAGE AT REDSTONE ARSENAL (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

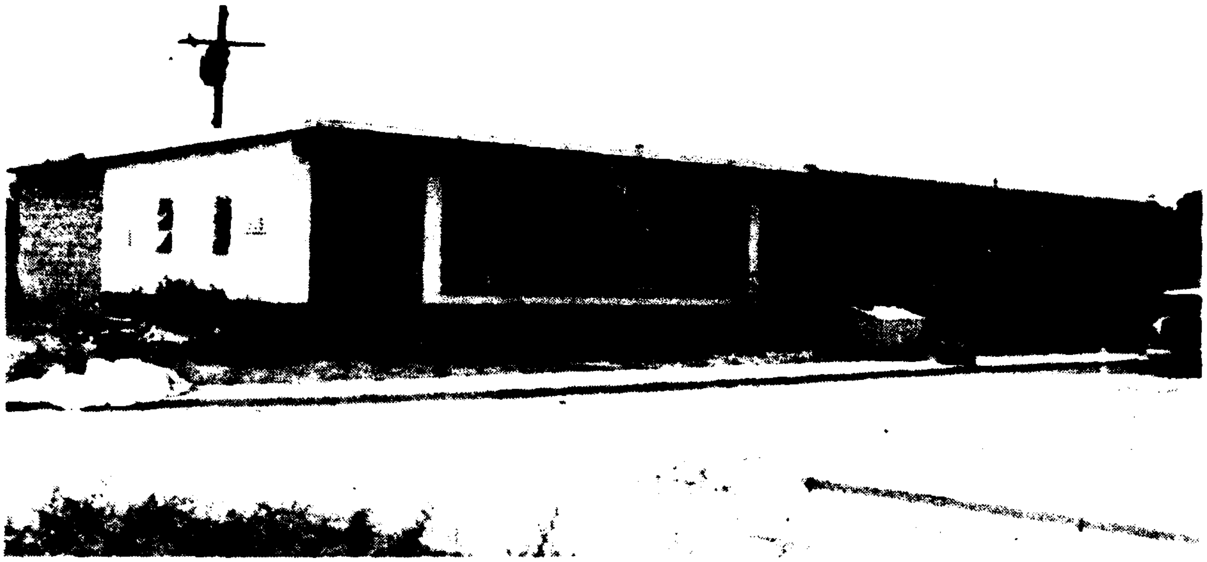


PLATE 9. CONCRETE SLUMP BLOCK STRUCTURE TYPICAL OF THE POST-1950 SECOND BUILDING STAGE AT THE ARSENAL (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

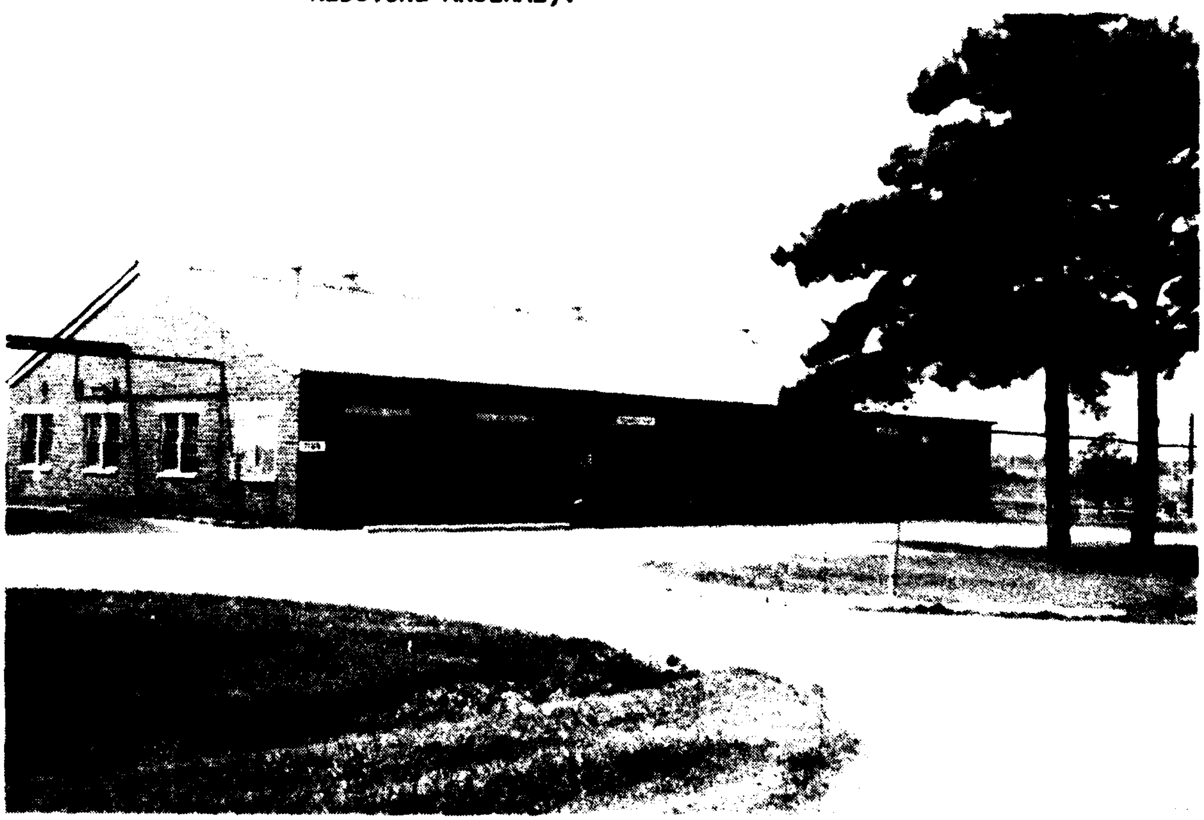


PLATE 10. FIRE BRICK STRUCTURE TYPICAL OF THE POST-1950 SECOND BUILDING STAGE (PHOTO SUPPLIED BY THE PUBLIC RELATIONS OFFICE, REDSTONE ARSENAL).

Urban Development in the Project Area

The growth and development experienced by Redstone Arsenal since its inception has had a profound impact, in terms of population growth, on the surrounding countryside and in Huntsville proper. Up until the 1960s, when the increased interest in the space program demanded the development of the George C. Marshall Space Flight Center, population within the southern Madison County area had been relatively stable. Major impact to the land, and also to the archaeological resources, had come from agricultural activities, and such land or hydrological modifications as the channelization of Huntsville Spring Branch. Two factors contributed to the burgeoning population of the region, beginning about 1960. One was the aforementioned step-up in the space program, and the second was, and is, the increasingly evident migration into the so-called "Sun Belt" states from the north and northeast. Aerial photographs taken during the course of the project (Plates 11 and 12) indicate the degree of westward expansion of Huntsville, primarily in the form of suburban development. It should be noted that several archaeological sites have been obliterated within the last five-year period alone, and, while the presence of Redstone Arsenal will limit the degree of expansion, it is apparent that many cultural resources known to be located between the present Huntsville City limits and the Arsenal will be lost, due to continuing development, within the next ten years.

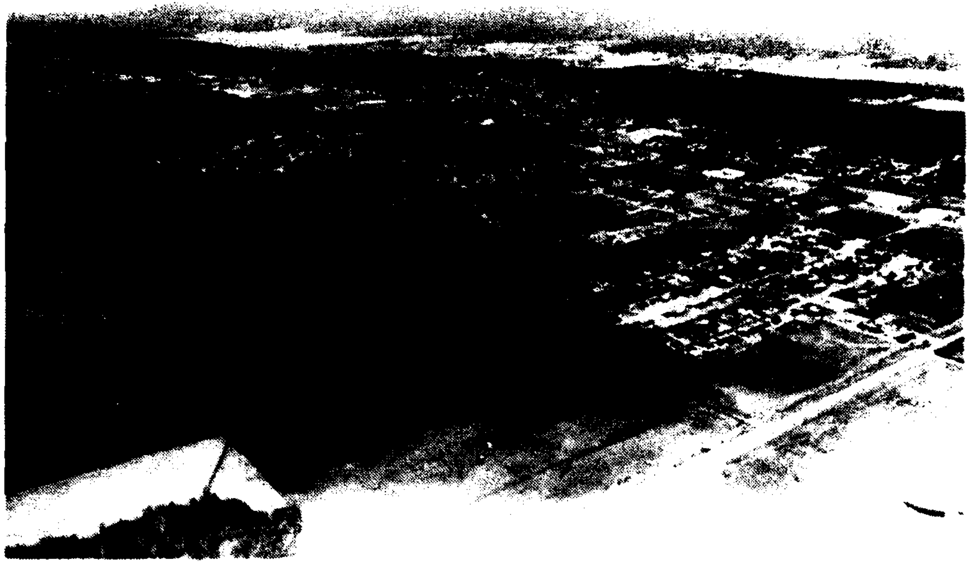


PLATE 11. AERIAL VIEW LOOKING NORTHEAST TOWARD THE CITY OF HUNTSVILLE. THE EXTENSIVE SUBURBAN DEVELOPMENT EXTENDING INTO THE FIELD AREAS HAS OCCURED WITHIN THE LAST TEN YEAR PERIOD.

PLATE 12. AERIAL VIEW LOOKING EAST FROM THE APPROXIMATE CENTER OF THE PROJECT CORRIDOR. THE HOUSING DEVELOPMENT IN THE PLATE CENTER ABUTTS THE EASTERN BOUNDARY OF CORRIDOR.

5. RESEARCH DESIGN AND THEORETICAL ORIENTATION

By

L. Janice Campbell and Prentice M. Thomas, Jr.

The principal goal of this project is the development of a predictive model of site location, which will prove useful in future planning at the Redstone Arsenal. The site data derived from the sampling program, however, are also directed toward addressing two general research topics: 1) a determination of the chronological periods (or phases) represented in the project area; and 2) an interpretation of settlement/subsistence patterning through time. Under each of these topics, several issues may be explored. Each of these research questions are discussed in this chapter, although the bases for some of the issues, such as chronology, settlement and subsistence patterns, have been outlined in Chapter 2, with the salient points briefly reviewed below.

Predictive Modeling

The utilization of models in both prehistoric and historic archaeology has proved to be an effective tool for interpreting data and formulating theory. The types of models vary significantly depending upon the specific data base; however, the development of models, as a conceptual framework, essentially enables the researcher to determine relationships between variables and to understand and explain observed phenomena (Read 1974). The increased application of this analytical approach must be viewed as basically an outgrowth of developments in modern archaeological theory.

Although stimulated by work undertaken earlier (Brainerd 1951; Spaulding 1953), as American archaeology entered the 1960's, a rather radical shift in orientation was underway. The use of mathematical models and systems theory became quite popular, as well as the application of models drawn from economic geography. The various approaches share in an attempt to go beyond chronology and culture history. There is an emphasis on observing regularities or patterns resulting from past human behavior, and attempts are being made to deal systematically with archaeological manifestations of social organization such as residence patterns and political organization. Following the work of Spaulding (1953; 1968), quantitative techniques are now being applied to archaeological problems with increasing sophistication.

Among the myriad of problems in which quantitative measures are being used is that of explaining site location. Models drawn from economic and cultural geography have been applied to such diverse areas as Neolithic Mesopotamia (Johnson 1972) and Late Classic Yucatan (Flannery 1976; Marcus 1974). A volume devoted to the application of a wide variety of models to archaeological data likewise touches upon the question of settlement location (Clarke 1968); and, in 1971, a

conference held in the southwestern U.S. produced an entire volume exploring the variables influencing selection of settlement location (Gumerman ed. 1971). More recently, a number of publications have appeared, focussing on spatial analysis in archaeology. These works, such as D. L. Clarke's Spatial Archaeology (1977) and Hodden and Orton's Spatial Analysis in Archaeology (1976), include one aspect of spatial analysis, the concern with site location. All of these advances have been devoted to increasing our understanding of the factors affecting site preference, even though the various approaches address specific issues.

In terms of cultural resource management studies, the most widespread and frequent application of modeling has been to enable investigators to make predictive statements regarding site location. The value of predictive modeling is witnessed in two ways. First, when based on sampling results, it provides an instrument for planning future development or construction within a particular project area. Second, predictive models supply a working outline for interpreting the variables that influenced settlement and, thereby, developing a series of hypotheses that can be tested by future work.

The successful development of a predictive model in sampling survey is based on three premises. One, that the variables selected have a basis in reality for a given project area. Two, that the universe concerned with the model has been sampled in such a manner as to be representative of the pertinent conditions extant within that universe. And three, after subjection to statistical validation, the model is flexible to revision, refinement, or modification.

The validity of predictive modeling lies in the rigorous adherence to the substance of the premises. Further, in considering the size of the test area and the parameters which influence cultural resources within that area, the project must be based upon a sampling procedure designed to be as close as is possible to representing the full range and variation of sites within the test universe. The sampling strategy developed for the Redstone Arsenal project is thoroughly discussed in Chapter 7; however, the primary objectives are to provide a basis for surveying a representative sample of all landforms in the project area. Such an approach should result in the location of a cross-section of all types of sites and their settings in the project corridor.

Based on the results of the sample survey, a preliminary model may be developed that differentiates high and low probability areas for site occurrence. These data may then be combined with all of the site information available in the corrider. Sites located by previous researchers and those found by our crews in non-sample survey units may, therefore, be added to the sample survey data to provide a more complete picture of site distribution in the area. In effect, these additional sites may serve as a test of the model developed on the basis of the sample survey, and may provide a basis for altering the

model. Finally, the model may be applied to other portions of the Arsenal in an effort to predict the potential for sites to be located in unsurveyed areas.

Chronology and Settlement Pattern

Assuming the statistical validity of our sampling procedure, coupled with the larger body derived from excavation and previous research efforts, the project offers an excellent opportunity to address several issues pertinent to understanding prehistoric occupation in the Redstone Arsenal project area, as it is reflective of prehistory in the Tennessee River Valley and Wheeler Basin cultural region (see Chapter 2).

Unlike many regions in the Southeast, the project area has been rather well studied, principally as a result of the extensive WPA investigations that were undertaken in the 1930s and 1940s. The WPA work has been followed by systematic and controlled investigations conducted by a number of individuals (cf. Alexander 1979; Futato 1979). Walthall, in his thorough summary of archaeology in Alabama (Walthall 1980), has presented full information on the nature of investigations, status of archaeological knowledge, and issues that should be addressed in the Middle Tennessee Valley and Wheeler Basin region. Consequently, this section will not attempt to replicate his information; but rather, using Walthall's summary, Dickson's interpretive synthesis (Chapter 2), and other pertinent research, we will be able to set the stage for a discussion of several issues that we hope to address with the project data.

Assessing the chronological placement of sites investigated during the survey and testing program is the first issue of concern. Obviously this determination is critical in terms of the predictive model since the data can be used to illustrate site probability in relation to temporal periods. Our work, therefore, is designed to provide an evaluation of the study corridor in regard to the chronological periods represented, and, if appropriate, the data will be used to offer refinements to the cultural sequence as presently defined. Such a determination is important in that chronological placement of sites is the first building block necessary to address other issues such as settlement and subsistence patterns.

Major shifts in the nature of settlement are known to have occurred; however, there is still continuing debate as to the stimuli for these shifts (see Chapter 2). Consequently, we feel it is imperative that a central focus of our investigations be devoted to broadening the understanding of settlement change. By addressing specific issues for which, at this point, we feel the data will be suitable, some clarification of the settlement and subsistence strategems will theoretically be possible.

The first issue relates to the changes that are believed to have occurred during the Archaic period. As pointed out by Dickson, there is some debate over whether the end of the Paleo-Indian period, which presumably saw the extinction of the large megafauna, ushered in significant alterations in settlement location that reflect subsistence pattern shifts. Williams and Stoltman (1965) see the more contracted distribution of Dalton sites, in comparison with earlier Paleo-Indian sites, as representing the beginnings of a shift in environmental adaptation. Dickson, however, demurs and points to his own data from the Duck River (Dickson 1976, 1979) in saying that he saw no significant change in the distribution of Paleo-Indian versus sites of later chronological period sites. In further support, he cites the Tellico Reservoir project in east Tennessee which located Early Archaic period sites in situations not formerly believed inhabited by these groups.

Walthall, who places the Dalton culture as the earliest phase of his four-phase division of the Early Archaic, notes that work conducted subsequent to Williams and Stoltman's (1965) article has revealed Dalton sites in several different locations. He notes, however, that the data do not contradict Williams and Stoltman, but simply expand the area that must be considered inhabited by Early Archaic peoples. Moreover, he says the trend continues into the next phase, Big Sandy. Similarly, Futato (1979:15) notes that Early Archaic sites of the Dalton-Big Sandy horizon are situated both in locations where Paleo-Indian sites are present and where they are rare, although in the latter locations later Archaic sites are often found.

The principal question here is, does the Early Archaic settlement pattern represent the beginnings of an adaptive shift from preceeding Paleo-Indian site locations or, as Dickson suggests, the site data are too limited to judge this and eventually we will see more continuity than difference between the earlier and later settlement trends.

Alexander (1979) identified three sites, 1Ma103, 1Ma110, and 1Ma182 for which he suggested a date of either Early Archaic or Paleo-Indian. Since the present data clearly indicate these early occupations are represented in the project area, our investigations are directed toward evaluating the relationship between Paleo-Indian and Early Archaic site location, and the relationship between Early Archaic site locations and those of later Archaic periods.

The next issue concerns the nature of the Middle Archaic occupation in the project area. Dickson has suggested that the Sanderson Cove phase, which is the single phase designated by Walthall (1980) for this period, may have been preceeded by an Eva-like phase similar to the Eva phase in Middle Tennessee (Lewis and Lewis 1961). They point to the presence of Morrow Mountain points stratigraphically overlying Eva points at the Eva site in Tennessee as evidence of the latter being antecedent to Morrow Mountain. At Redstone Arsenal, Alexander found considerable evidence of Middle Archaic components

marked by the presence of Morrow Mountain points. At one of the sites, 1Ma156, however, he identified an Eva point. The recovery of a single Eva point found on the surface is rather meaningless in assessing the presence or absence of an Eva-like phase preceeding the Sanderson Cove phase. But, one of the questions we hope to address, if the data are appropriate, is whether there is a Middle Archaic phase prior to Sanderson Cove, and, if so, is there a relationship to the Eva phase identified in Tennessee.

Probably one of the most significant and intriguing research issues focuses on the nature of Late Archaic occupation in the project area. Dickson (Chapter 2) has devoted an extensive discussion to presenting various interpretations of Late Archaic cultural developments.

For the present project, we are particularly interested in assessing the type of settlement/subsistence systems operating during the Late Archaic period in the project area. The region has long been noted for frequent evidence of shell midden sites dating to this period. Such occupations clearly point to riverine-based exploitation of shellfish, although these cultures were probably engaged in the exploi tion of a wider spectrum of environmental resources.

Since our survey corridor will include a number of physiographic zones including both upland and riverine areas, we are particularly interested in evaluating the Late Archaic seasonal schedule. We would expect, for example, a range of site types to be located in several physiographic zones.

As an augment to this issue, the determination of subsistence is crucial to an understanding of both the nature of occupation in northern Alabama during this period and the relationship of these occupations to other cultures. Palynological samples are one of the best means for determining if climatological changes dictated the subsistence strategies for this period. Botanical analysis of feature or midden material, if encountered, will also prove valuable to determining the subsistence economy. These data are particularly important to address several viewpoints on whether semi-domesticates such as Chenopodium sp. were being cultivated in the floodplains, whether the subsistence base was primarily shellfish harvesting supplemented by hunting of animals such as white-tailed deer, or whether a combination of seasonally scheduled subsistence procurement strategies were being implemented.

The next issue of concern in this project relates to both the Middle Woodland Copena phase and the Late Woodland Flint River and McKelvey phases. It appears that in the Copena phase, a trend begins that becomes more starkly evident in the subsequent Late Woodland period. This trend was marked by a geographic division in the distribution of certain minor ceramic types including, cord-marked, brushed, and rocker-stamped limestone-tempered wares. According to Walthall (1980), these decoration styles appear only at Copena sites located east of Green Mountain. Although they constitute minor frequencies in

the Middle Woodland period, the brushed limestone-tempered ceramics become a dominant type in the Late Woodland Flint River phase, which is distinguished from the contemporary McKelvey phase by being restricted to the east side of Green Mountain. However, the McKelvey phase, characterized by a grit-tempered series and presumably more related to the cultures of the Lower Mississippi Valley, is restricted in distribution to the western side of Green Mountian.

Walthall (1980) suggests that this early appearance of geographic discontinuity may indicate that Copena was made up of two autonomous tribes that later developed into the two distinct cultures of Flint River and McKelvey. In light of available data from known sites in the project area, we feel that the resolution of the questions regarding the transition from Middle Woodland to Late Woodland is important for our study area. Also of interest are the apparent geographical differences in manifestations of these periods. We have an opportunity to investigate the validity of the concept that Green Mountain formed a major boundary between cultural groups. Our project area falls very close to, and on the western margin of Green Mountain. If this physiographic feature did serve to divide cultures, we would expect the sites located in the study area to be consistent with the phases delineated to the west. For the Late Woodland occupations, our data should reveal the markers of the McKelvey phase to be dominant at sites of this period.

If the data reveal significant differences from the expected distribution,the suggestion of Green Mountain as a cultural boundary must be reevaluated and the area of cultural divergence reassessed. Because of the proximity of our study corridor to Green Mountain, the possibility of defining a contact or transition zone between the two distinctive and contemporaneous cultural traditions cannot be overlooked.

The final issue to be addressed by this project focuses on the apparent absence of Early Mississippian occupation in the project area. The closest manifestation of the Early Mississippian period is the Langston phase recognized for the Guntersville Basin. Walthall (1980:267-268) notes that this culture seems to have emerged from the indigenous Flint River culture of the Late Woodland period. But even if Flint River cultures did characterize the Late Woodland period in the Wheeler Basin, it is possible that an hiatus occured during the Early Mississippian for some, as yet undetermined, reason. Later Mississippian Hobbs Island culture is definitely present as indicated by the WPA excavations at 1Ma33/50 and 1Ma31/32. The former has already been discussed because of its Late Woodland component, but a Hobbs Island component was also isolated in the mound (1Ma50). At the latter site, H. Summerfield Day uncovered an extensive Mississippian village, 1Ma33, with numerous structural patterns and two associated mounds.

The question here is obvious. Was there an hiatus in the project area during the Early Mississippian period when the area was abandoned

until later during the period? Or, is there an Early Mississippian phase represented that has not been well-defined? Our investigations may be of some help in addressing these questions.

In sum, as mentioned the primary goal of the project is the development of a predictive model. The applicability of the model will be partially substantiated by the resolution of the five research issues which are the principal concerns of this project. They concern: 1) the nature of Early Archaic settlement/subsistence patterning in relation to preceeding Paleo-Indian and succeeding Archaic patterns; 2) the presence of a possible Middle Archaic Eva-like phase preceeding the Sanderson Cove phase; 3) the nature of Late Archaic settlement and subsistence systems; 4) the nature of the Middle-to-Late Woodland transition and assessment of the validity of presently assumed geographical division at Green Mountain to distinguish cultures; and 5) the nature of Early Mississippian occupation in the project area.

6. GEOMORPHOLOGY AND ARCHEOGEOLOGIC SUMMARY

By

John P. Lenzer

Introduction

The study area is located on rolling uplands and flat alluvial terraces, nearly on the boundary between two geomorphic provinces: the eastern edge of the Highland Rim province of the Interior Low Plateaus, and the western edge of the Cumberland Plateau Sub-Province of the Appalachian Plateaus Province (of the Appalachian Highlands) (Figure 8). Cutting across this boundary is the relatively narrow, winding valley of the Tennessee River. The intermittent geologic record spans nearly 300 million years, and the geomorphic history preserved in the local landforms, deposits, and soils covers at least several million years. Traces of prehistoric and historic human occupation in the area, although they record events during only the past ten to fifteen thousand years, are interesting to geologists as well as archaeologists. These traces can be used to help define and resolve natural processes and events of latest Quaternary time.

This report treats the geomorphology and geomorphic history of the study area. Fieldwork for the geological and geomorphic study was performed during January and February, 1980.

Objectives and Methods

The geological study was undertaken to address four specific goals:

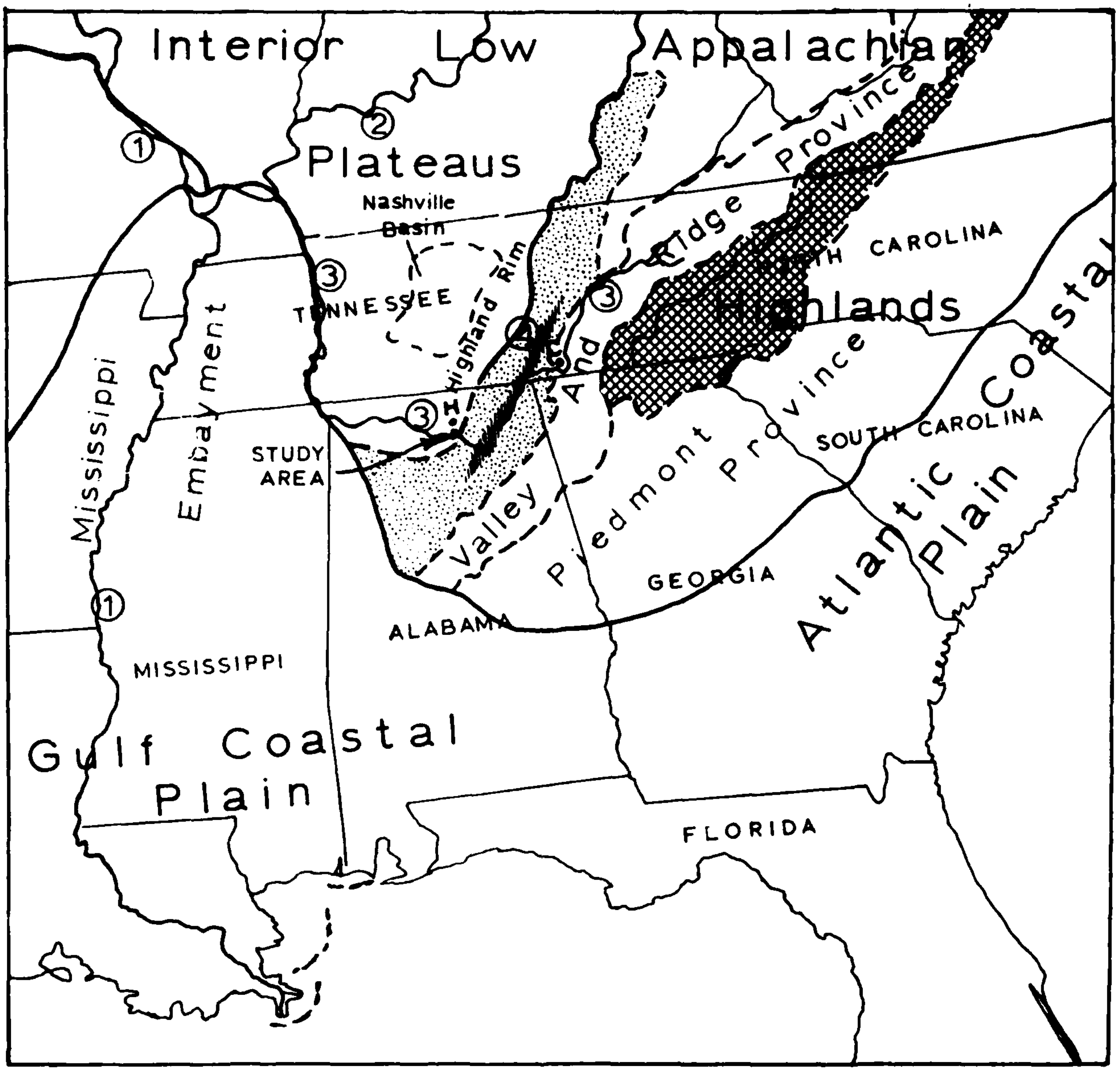
1) to locate and define present stratigraphic, geomorphic, and pedomorphic features;

2) to define (in general terms) rates of erosion, alluviation, colluviation, and soil formation;

3) to attempt to locate relatively deeply buried cultural resources; and

4) to provide a summary of the geology and the geomorphic history of the area, in particular, the period since the last maximum spread of continental glaciers (i.e., the past 18,000 years).

In addition to the major goals, the geological work was designed to contribute to the archaeologists' development of a predictive model of the nature, extent, location, and distribution of cultural resources in the study area. The final goal was to assist the archaeologists in identifying source areas of raw materials used by prehistoric and historic human inhabitants.



LEGEND

- BOUNDARY OF GEOMORPHIC PROVINCE
- BOUNDARY OF GEOMORPHIC MAJOR DIVISION
- CUMBERLAND PLATEAU
- SEQUATCHIE VALLEY
- BLUE RIDGE

C CHATTANOOGA

H HUNTSVILLE

RIVERS:

1. MISSISSIPPI
2. OHIO
3. TENNESSEE
4. SEQUATCHIE

FIGURE 8. PHYSIOGRAPHY OF SOUTHEASTERN NORTH AMERICA.

In order to reach these goals, the study was planned to proceed in four phases. In the first phase, prior to field operations, a review of the geomorphic, pedologic, and paleoenvironmental literature was conducted to provide information about the study area and the region in which it is located. In undertaking this review, maps and aerial photographs were also examined. The second phase comprised a general field survey of the study area to locate and define present stratigraphic, geomorphic, and pedomorphic features. Results of this work were then compared to the data accumulated in the first phase. For the third phase, the geologist and archaeologists jointly conducted a program of subsurface investigations of a sample of all major landform and environment types in the survey corridor. This was principally accomplished by placing backhoe trenches throughout the study corridor. Supplementing these were observations of road and drainage cuts, gravel quarry walls, and natural river cutbanks. The last phase involved collating and comparing information from the three others, and preparing this report.

As planned, work was initiated by conducting a review of all available primary and secondary source material, following which, field operations were conducted. The field survey to define landforms and the initial stage of subsurface testing was undertaken prior to arrival of the archaeological team. The next period of fieldwork coincided with the final weeks of archaeological field investigations, at which time attention focused on the archaeological sites, the landforms on which each site is located, the surrounding terrain, and the location of nearby resources such as water and lithic materials.

In detail, the fieldwork comprised several sub-operations. Supplemented by analysis of aerial photographs and maps, observations of landforms were made throughout the study area, and at various places around the periphery of the Huntsville Spring Branch drainage basin. Attention was focused on delineating the distribution of landform and soil types, both of which might have been of importance in prehistoric site location. Also, evidence of historic modifications to the landscape were carefully noted. A preliminary set of definitions of "physiographic associations" (categories based on major landform distribution) and "landform elements" (surfaces, slopes, and drainage features) was prepared for the archaeologists during the first phase. These definitions were refined and supplemented as necessary during the second phase of fieldwork.

In preparation for the deep-testing work, the Arsenal topographic maps (contour interval five feet or 1.5 meters), soils data, and the actual terrain were compared and analyzed. Soil profiles showed that historic clearing for agriculture had caused much erosion of upland soils, and presumably, much deposition in swales, sinks, and basins. It was decided to concentrate testing in those areas in which both deposition and the possibility of human occupation had been likely.

The subsurface investigation using the backhoe was divided into two parts: 1) initially, samples of the various landform elements present in the study area were tested in order to check the published soils and geologic information; and 2) a concentration phase, in which areas were tested where the occurrence of alluviation, colluviation, or other types of sediment accumulation had been demonstrated or was considered likely. In addition, backhoe trenches were placed in and near archaeological sites wherever the geologist and archaeologists required supplementary information.

All trenches were cut under the supervision of either the geologist or his assistant. At each of the 60 backhoe trench locations, after initial scraping of grass, etc. and the "A" soil horizon, the walls of the trench were inspected for artifacts or evidence of archaeological features. Trenching continued generally until an identifiable lower "B" or a "C" soil horizon was exposed. Walls were cleared by trowel and shovel to remove smears caused by the backhoe bucket. In relatively homogeneous material, descriptions were limited to one to three sections spaced along the weathering profile. Munsell colors, texture, consistency, moisture content, stratification, and other features were described. The geomorphic situation, length, and orientation of the trench was logged, and its location marked on the Arsenal maps.

Supplemental data on soils and stratification were obtained from road cuts, drainage ditches, quarry and borrow pit faces, and the cutbank along the Tennessee River. Geologic sections were logged for the same set of features as were the backhoe trenches. A set of drilling logs from borings placed throughout the Arsenal for a ground-water investigation (Testing Inc. 1979) was also helpful. The quality of information was quite variable, however, and the data for those borings in the study corridor were useful only for determination of depths to unweathered bedrock.

Regional and Project Specific Geology and Geomorphology

The best general report on the geology and geomorphology of Alabama is Adams et al. Geology of Alabama (1926). The Alabama Geological Survey has intensively investigated the geology and hydrology of Madison County and the Huntsville area. Their results are presented in several publications. Basic geologic features of the county were summarized by Glenn Malmberg and T. H. Sanford, Jr. (1963). Ground water studies include those by LaMoreaux (1949), LaMoreaux et al. (1950), Malmberg and Downing (1957). Two environmental atlases (Geological Survey of Alabama 1973 and 1975) contain maps and brief reports on ground water, geology, climates, soils, and vegetation of the area covered by Madison County.

The Soil Survey of Madison County, Alabama (Swenson et al. 1958) was invaluable, particularly for information relevant to determinations of soil and landform stability. Published investigations of subsurface "stone lines" (Parizek and Woodruff 1957; Ruhe 1959), and

sediment movement on hillslopes (Culling 1963; Young 1963; Moss et al. 1979; Moss et al. 1980), although they do not treat Madison County, deal with features similar to some of those observed in the study area. A study of long-term stability of very gently sloping coastal plain surfaces in North Carolina (Daniels et al. 1971) was useful for comparison with data and conclusions from the Redstone Arsenal project.

Regional Geology and Geomorphology

East of the study area lie the Appalachian Highlands (Figure 8). Major structures and landforms of the southern Appalachians trend northeast-southwest. Along the southeastern side of the highlands, the hilly Piedmont Province (or "Piedmont Plateaus" or "Piedmont Upland"), comprises highly-dissected, rolling terrain. The hills are formed on folded, warped, and faulted pre-Cretaceous (older than 60 million years) rocks. Mean slope of the province is to the southeast, and it forms a band 150 to 200 kilometers (93.2 to 124 miles) wide between the high, well-defined Blue Ridge and the gently-sloping, flat-lying rocks of the coastal plain.

Hard, crystalline (igneous and metamorphic) rocks of the Blue Ridge have eroded more slowly than the flanking weaker rocks. As a result, the ridge forms a long, relatively high core in the Appalachians. This feature is not located in Alabama, however, the Tennessee River and its tributaries drain the northwestern side of the southern portion of Blue Ridge.

Valleys and ridges of parallel-folded and faulted Paleozoic (older than 225 million years) sedimentary rocks form the aptly-named Valley and Ridge Province. The valleys and ridges trend parallel to the general grain of the Appalachians, bending slightly around the southwestern end of the Blue Ridge. In Alabama, the Valley and Ridge Province is bounded to the southeast by the higher, dissected hills of the Piedmont Province. Well-defined ridges and valleys range between one and five kilometers (.62 and 3.1 miles) in width, with ridges narrower than valley floors. The Tennessee River and its tributaries drain a portion of this province northeast from the termination of the Blue Ridge. The general course of the Tennessee River in the province is southwest to a point just east of Chattanooga, where it leaves the province, heading west.

Westernmost of the Appalachian geomorphic provinces are the Appalachian Plateaus. The southwestern portion of this province, in Kentucky, Tennessee, and Alabama, is termed the Cumberland Plateau. Gently-warped, gently-dipping, late Paleozoic sedimentary rocks underlie the landforms of the province. The nearly-horizontal rocks have been dissected into relatively flat-topped mountains, with steep to moderately sloping valley walls. Typical Cumberland Plateau landforms are present east of the study area. A long, flat-topped ridge, Monte Sano-Huntsville Mountain-Green Mountain, is an outlier of the plateau; it stands almost 300 meters (984.2 feet) above the floor of

the Flint River valley to the east. In the plateau proper, valleys of major streams are much narrower than that of the Flint River, typically less than one kilometer (.62 miles) wide.

The Tennessee River, after its westward turn at Chattanooga, flows at the bottom of a series of meander-like curves which were cut down into bedrock through the originally continuous Walden Ridge and Sand Mountain. These broad, relatively flat-topped ridges form the eastern margin of the Sequatchie Valley (Figure 8). The Sequatchie Valley extends northeast-southwest for more than 200 kilometers (124.3 miles) in Tennessee and Alabama. It is generally three to five kilometers (1.9 to 3.1 miles) wide, and is bounded by escarpments and dissected hills on both sides. Local relief is typically between 150 and 200 meters (492 to 656 feet).

The valley is formed in the rocks of a faulted anticline, similar to those of the Valley and Ridge Province. Up-arched Pennsylvanian sandstone which lies at the top of the Cumberland Plateau has been eroded from the crest of the anticline, exposing older limestone layers. Erosion of the crest of the elongated arch left the formerly lower flanks of the anticline as flat-topped hills (Sand Mountain, Walden Ridge, and the dissected upland west of the valley). The Tennessee River follows the axis of the valley southwest for approximately 80 kilometers (49.7 miles), then again cuts westward across gently-dipping, relatively flat, Cumberland Plateau strata. This second cross-cutting section also contains incised meander-like bends. The departure from the structure-controlled valley is more radical than the one east of the Chattanooga, as the mean bearing of the river course changes from southwest to northwest. In the angle between southwest and northwest-flowing portions of the river, the Cumberland Plateau is strongly dissected. It is this area that contains the plateau edge east of the study area.

West of the Cumberland Plateau escarpment and north of the Tennessee River Valley, the terrain comprises low, rolling hills, with abundant closed and open basins ("sinks"). Hillcrests of this area, the Eastern Highland Rim of the Interior Low Plateaus Province, lie 200 to 300 meters (656 to 984 feet) lower than ridgecrests of the Cumberland Plateau. Bedrock of the Eastern Highland Rim in the study area (and formerly over much of the rest of the province) is Middle Paleozoic limestone. Abundant sinks occur in uplands and along drainage systems. A structural dome in Central Tennessee (the "Nashville Dome") has caused the limestone strata to dip gently away from it. In the study area, the mean regional dip is to the south. Hillcrests in the northern portion of Madison County lie at elevations slightly above 273 meters (836 feet) ASL (above sea level); 23 kilometers (14.3 miles) south (similarly on hillcrests developed on weathered limestone bedrock), maximum crestal elevations are close to 180 meters (531 feet) ASL.

From the northwestern corner of Alabama, the Tennessee River Valley runs nearly north across Tennessee, then north and northwest

across western Kentucky, to its juncture with the Ohio River. This portion of the Tennessee River Valley is the boundary between the Interior Low Plateaus and the Mississippi Embayment of the Gulf Coastal Plain. Coastal plain strata comprise relatively flat-lying, gently-dipping post-Cretaceous sedimentary rocks and unconsolidated sediments. They record the gradual, intermittent retreat of the ocean over the past 60 million years. Outcrop areas curve around the southwestern termination of the Cumberland Plateau and Interior Low Plateaus. Relief is low; dissection is well advanced. Elevations of coastal plain hills adjacent to the higher plateaus range between 70 meters (230 feet) and 100 meters (328 feet) ASL.

Geomorphic History of the Study Area

The character of the land surface and bedrock in the study area fit well within the general models of carbonate terrain evolution reviewed by Stringfield and LeGrand (1969). Unfortunately, there are few clues to the absolute (or even the geologic) dates of events in the geomorphic history of the area.

Early Uplift and Retreat of Cumberland Plateau Rim: The last recorded marine deposition in the area occurred during the Early Pennsylvania Period; the sediments became the hard, massive Pottsville sandstone which now caps the Cumberland Plateau to the east. Uplift, folding, and thrust-faulting of the region to the east ended deposition in this basin. However, the Cumberland Plateau rocks and those of the interior low plateaus were relatively undisturbed. They were subject to erosion, however. Strata of the present Cumberland Plateau formerly extended over the study area and probably over the Nashville Dome. Erosion has cut back the edge of these rocks by probably several hundred kilometers (a few hundred miles), and removed a thickness of at least 225 meters (750 feet) of sandstone, shale, and limestone from above the Tuscumbia limestone.

It is certain that the region was close to sea level during the Late Cretaceous (around 65 to 70 million years ago). Upper Cretaceous rocks, formed from coastal and shelf deposits of the ancestral Gulf of Mexico, form the edge of the Gulf Coastal Plain which curves around the Appalachian Highlands (Figure 8). The upper Cretaceous rocks lie within 105 kilometers (65 miles) west of the study area, and upland surfaces developed on them lie less than 75 meters (250 feet) lower than adjacent portions of the Cumberland Plateau.

It is also certain that karst topography had developed on exposed Paleozoic limestone prior to deposition of the late Cretaceous, ancestral Gulf of Mexico sediments. Stringfield et al. (1974:28) note that

> "...in Franklin County in west Alabama, karst features are found beneath the unconsolidated rock of the Tuscaloosa Group of [late] Cretaceous age, which represents the innermost part of the Gulf Coastal

Plain. Peace (1963:13) describes channels and collapsed rock in the limestone there beneath the Tuscaloosa Group..."

Origin of the Tennessee River: Most interpretations of the origin of the Tennessee River begin with its presence on a broad coastal plain during the late Cretaceous (Thornbury 1954:124-125). The absence of datable fossils in ancestral Tennessee River deposits makes interpretation of its subsequent history difficult. The once freely-meandering coastal plain river probably incised its course into Pottsville bedrock east and west of Chattanooga, and at its exit from the Sequatchie Valley during another uplift of the Appalachian region in Early Cenozoic time (i.e., shortly after 65 million years ago) (Adams 1928:487).

Development of Karst Topography: Whatever the pre-late Cretaceous status of karstification in the area, erosion of Cumberland Plateau rocks, collapse over sinks, and development of solution channels were probably rapid during the Early Cenozoic uplift, and during a late Cenozoic uplift that pushed the Appalachian Highlands and adjacent plateau regions nearly to their present elevations (Malmberg and Sanford 1963).

The upper and lower relict Tennessee River terraces, and the recent terraces record three different phases of floodplain formation following episodes of down-cutting in response to downward changes in base level. Solution channels which controlled development of the landforms of the area were probably formed in the zone of active ground water circulation associated with the floodplain which became the earlier relict terrace (or a higher, completely obscured predecessor), judging by the elevations of the various features.

Historic Changes: The principal historic changes include 1) clearing of the land for agriculture through the nineteenth and twentieth centuries; 2) channellization of the drainage, including Huntsville Spring Branch; and 3) damming of the Tennessee River in the second and third decades of the twentieth century. Effects of these changes on the landforms and geomorphic processes have been discussed above. In brief, their effects have been 1) to increase erosion and disturb the forest soils which had been continuously present for thousands of years; 2) to disrupt the balance of surface-subsurface drainage system to a large extent; and 3) to obscure many important (to the geologist and archaeologist) aspects of the Late Quaternary environment.

The Study Area: General Characteristics

Topography and Local Relief

The study area covers a portion of the Eastern Highland Rim section of the Interior Low Plateaus physiographic province (Fenneman

1938)(Figure 8). Bell Hill, in the southeastern portion of the study corridor, and Monte Sano-Huntsville Mountain-Green Mountain to the east, are outliers of the Cumberland Plateau Province. Other outliers of the plateau are Weeden and Madkin Mountains, north of the Huntsville Spring Branch Basin.

The highest portions of Monte Sano lie between approximately 480 meters (1580 feet) and 500 meters (1640 feet) ASL. At the southern end of this mountain complex, Green Mountain has crestal elevations above 425 meters (1400 feet) ASL. Bell Hill, however, reaches only approximately 280 meters (920 feet) ASL, and the rolling uplands of the Highland Rim south of Huntsville lie below 195 meters (640 feet) ASL.

Low areas include the Huntsville Spring Branch Basin, approximately 170 meters (560 feet) to 173 meters (570 feet) ASL, and the Tennessee River Terrace, also 170 meters (560 feet) to 173 meters (570 feet) ASL.

Drainage

The Tennessee River is the master stream for all drainage in this portion of the Highland Rim and Cumberland Plateau. Stream basins of Madison County are shown in Figure 9. The study corridor lies in the Huntsville Spring Branch-McDonald Creek sub-basin of the Indian Creek drainage system. This system is bounded by the much larger Limestone Creek drainage basin on the northwest and west, the larger Flint River drainage basin on the north, northeast, and east (including the intervening Aldridge Creek Basin and Monte Sano-Huntsville Mountain-Green Mountain), and by the Tennessee River.

The Huntsville Spring Branch-McDonald Creek sub-basin is set off by a ring of low mountains, erosional remnants of Cumberland Plateau rocks. The branch, contrary to the usual pattern of major streams in the area, does not flow south into the river, but turns west, through the bordering ridge trend, and joins Indian Creek. The cause of this apparent anomaly is considered below.

Geology

Bedrock formations of part of Madison County are tabulated in Table 1, and their distribution is depicted on Figure 10. Most of the study area is underlain by deeply-weathered Tuscumbia limestone, which forms a wedge that thickens slightly from north to south. The Cumberland Plateau outliers are well-defined, stratigraphically and topographically.

No major active geologic faults are present in this region. The Geological Survey of Alabama (1975) reports that since the early 1800's, several earthquakes have been felt in northern Alabama. Some fifteen weak tremors have been detected since 1886.

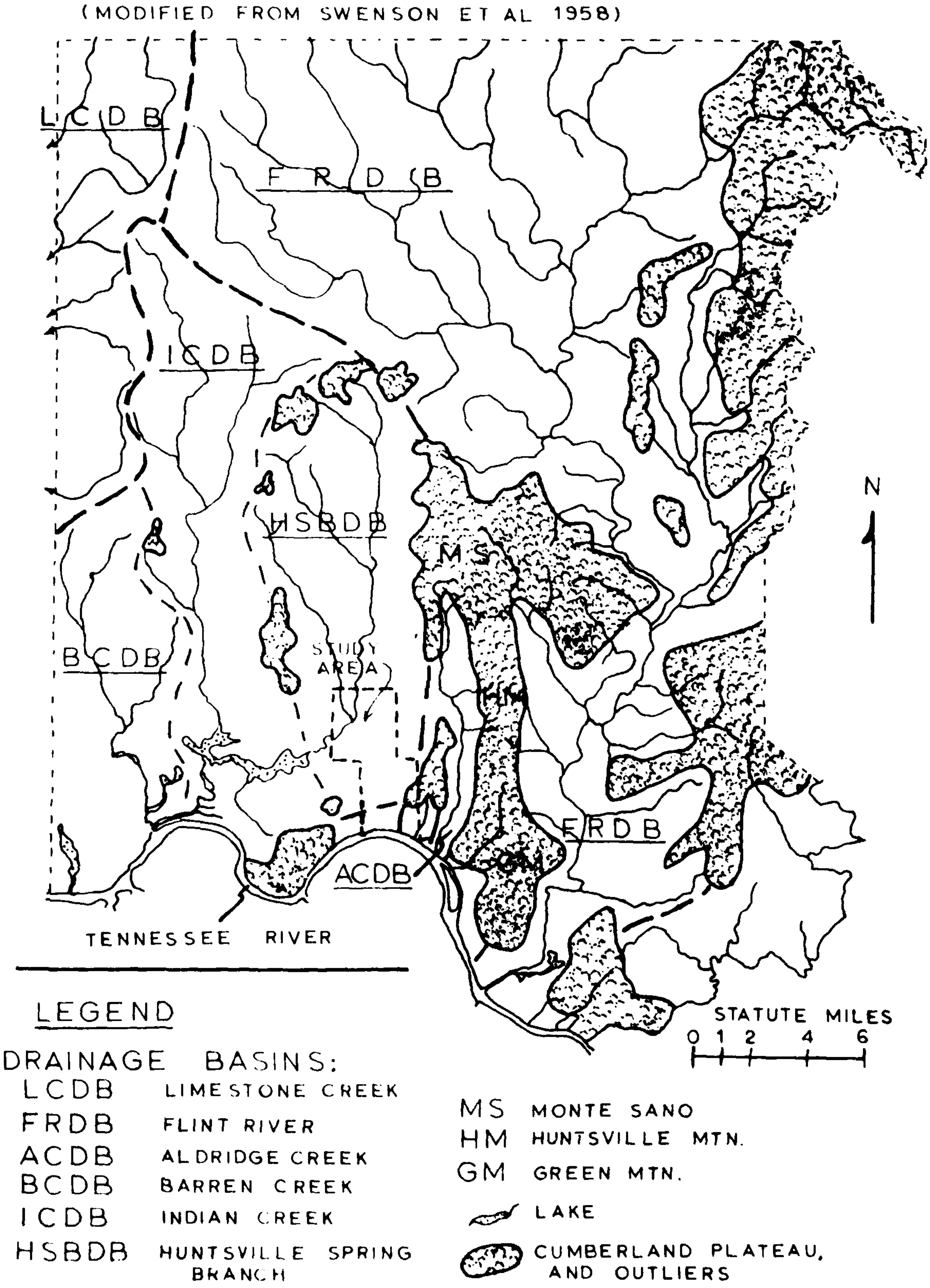


FIGURE 9. DRAINAGE BASINS OF MADISON COUNTY, ALABAMA.

TABLE 1. GENERALIZED GEOLOGIC SECTION IN MADISON COUNTY, ALABAMA
(From H.S. Chaffin, Jr. 1976, Table 1)

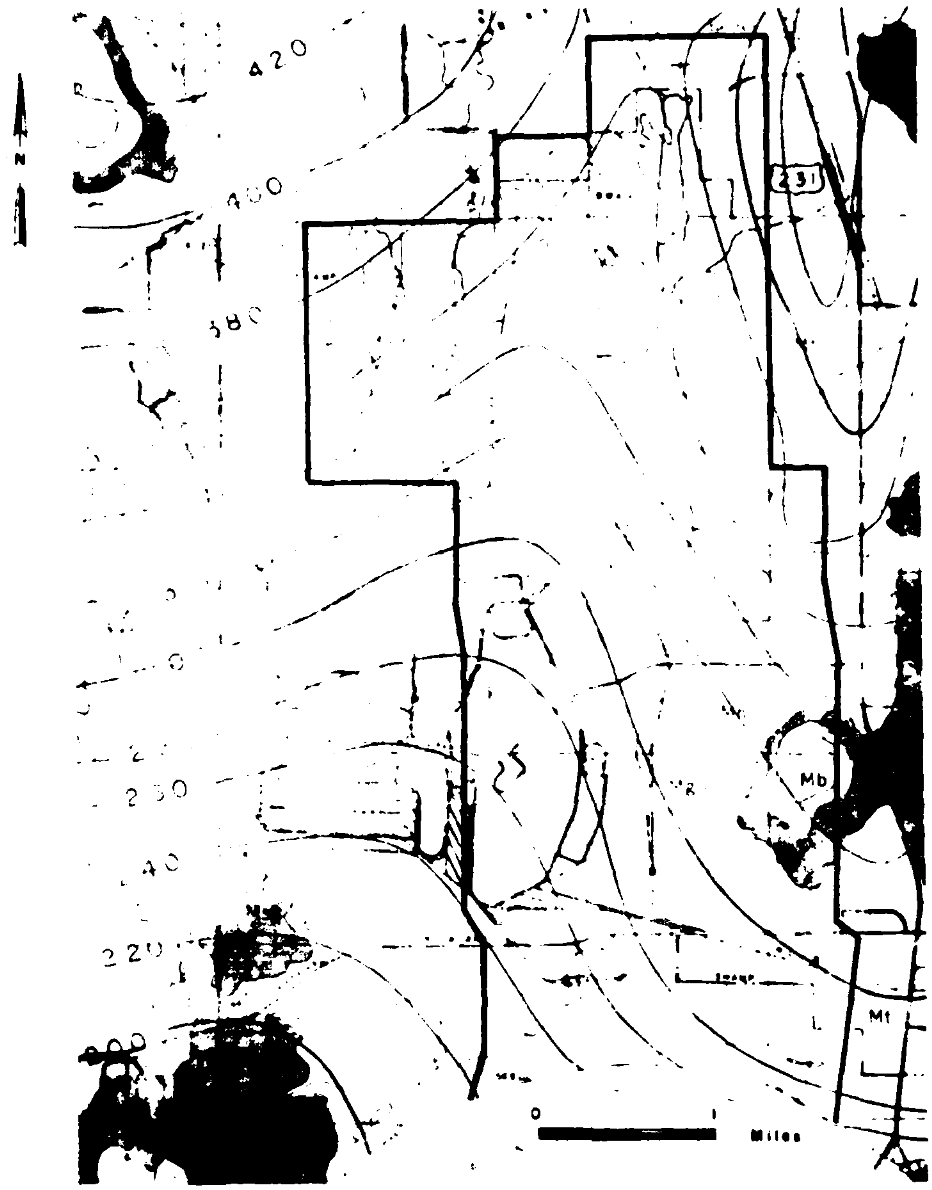
System	Unit	Thickness feet	Thickness meters	Lithologic Features
Quaternary	Regolith	25+	8+	Clay, silt, sand, and rock fragments, unconsolidated unstratified.
	Terrace and alluvial deposits	0-50	0-15.1	Gravel, sand, silt; unconsolidated, generally along present and ancient stream courses.
Pennsylvanian	Pottsville Formation	0-230	0-70	Sandstone, pale-yellowish-brown to medium-gray, fine-to coarse-grained, thin-bedded to massive, crossbedded; cliff-forming near base; interbedded with medium-gray shale. Thin coal near base.
Mississippian	Bangor Limestone	450-500	138-151	Limestone, dark gray, medium-grained, massive, crystalline, oolitic and bioclastic; interbedded with light-gray, fine-grained, thin-to medium-bedded, locally cherty dolomite that is most common in the middle part of the formation. Upper part of the formation is light-gray, thin-to medium-bedded, crystalline limestone interbedded with grayish-green to moderate-red, calcareous shale. Basal part of the formation is light-gray to greenish-gray, calcareous shale. Fossils occur throughout the formation.
	Hartselle Sandstone	0-80	0-25	Sandstone, light-gray to pale-yellowish-brown, fine-to coarse-grained, thin-to thick-bedded, crossbedded; with scattered small quartz pebbles; locally contains some medium-gray to greenish-gray shale.
	Pride Mountain	0-22	0-7	Shale, medium-gray to greenish-gray, with brownish gray, fine-to medium-grained, thin-to medium-bedded limestone interbedded with brownish-gray, calcareous, very fossiliferous clay shale at the base of the unit. This unit is included with Monteagle Limestone on the accompanying map.
	Monteagle Limestone	200-220	61-68	Limestone, light-to medium-gray, fine-to medium-grained thin-to thick-bedded, crystalline, fossiliferous; upper part contains some medium-gray shale beds and scattered chert nodules and lenses. Lower part characterized by light-gray, crossbedded oolitic limestone.
	Tuscumbia Limestone*	150-160	46-49	Limestone, light-to dark-gray, medium-grained, thin-bedded to massive, crystalline, bioclastic; contains some very light-gray to black nodules and thin beds of chert. The residuum of the formation is dusky-red to dark-yellowish-orange silty clay containing abundant fragments of hard chert.
	Fort Payne Chert*	155-185	48-58	Limestone, light-to medium-gray, fine-to coarse-grained, thin-bedded to massive, siliceous, crystalline, fossiliferous; contains abundant light-gray to black nodules

accompanying map.

	Monteagle Limestone	200-220	61-68	Limestone, light-to medium-gray, fine-to medium-grained thin-to thick-bedded, crystalline, fossiliferous; upper part contains some medium-gray shale beds and scattered chert nodules and lenses. Lower part characterized by light-gray, crossbedded oolitic limestone.
	Tuscumbia Limestone*	150-160	46-49	Limestone, light-to dark-gray, medium-grained, thin-bedded to massive, crystalline, bioclastic; contains some very light-gray to black nodules and thin beds of chert. The residuum of the formation is dusky-red to dark-yellowish-orange silty clay containing abundant fragments of hard chert.
	Fort Payne Chert*	155-185	48-58	Limestone, light-to medium-gray, fine-to coarse-grained, thin-bedded to massive, siliceous, crystalline, fossiliferous; contains abundant light-gray to black nodules and beds of chert. Usually represented by dark-reddish-brown to dark-yellowish-orange, clayey chert residuum.
Devonian	Chattanooga Shale*	0-25	0-8	Shale, carbonaceous, brownish-black to black, hard, fissile; pyrite crystals occur throughout the shale. Lower part composed of medium-gray, fine-grained, thin-bedded, pyritic, glauconitic quartz sandstone.
Silurian and Ordovician	Undifferentiated	1,105-1,158	337-353	Limestone, light-gray to brownish gray, crystalline, with some greenish-gray shale, and a few scattered thin beds of sandstone, dolomite, and dolomite limestone. Only the upper 25 feet (8m) of the unit is exposed in the county.
Cambrian and Ordovician	Knox Group*	1011+	308+	Dolomite, crystalline with abundant chert and rounded, frosted quartzose sand grains, limestone and shale.

* Underlie Tuscumbia Limestone in area.

- 2



Mb Bangor Limestone (Limestone, blue-gray, massive, crystalline, oolitic and in part fossiliferous; some dolomite limestone layers and shaly beds in upper part).

Mg Gasper Formation (Limestone, light-gray, argillaceous, crystalline, abundantly fossiliferous, oolitic in parts; some shaly zones).

Mh Hartselle Sandstone (Sandstone, tan to brownish-gray, medium - to coarse-grained, hard; locally contains beds of green shale and limestone).

Msg Ste. Genevieve Limestone (Limestone, light-gray, oolitic, thick-bedded, fossiliferous).

Mt Tuscumbia Limestone (Limestone, dark-to light-gray, crystalline, massive, fossiliferous; some cherty layers.

FIGURE 10. GEOLOGIC MAP OF PROJECT AREA.

Soil Development and Geomorphology

Swenson et al. (1958:Table 5; herein as Table 2) present a useful summary of local soils based on topographic position, parent material, and drainage. For use in geomorphic interpretation, our field investigations indicate that their category definitions can be modified to state:

1) outcrop areas with patches of thin soils less than 0.6 meters (two feet) thick around bedrock exposures; these occur on mountain and hilltops and upper slopes; they include Swenson et al.'s (1958) rocky and stony soil varieties.

2) areas with thin, continuous soils 0.3 to two meters (one to six feet) deep over parent limestone bedrock; principal soil types are Talbot, Colbert, and Pearman; the soils have been formed on material weathered in situ and not subsequently transported.

3) areas with thicker soils on deeply weathered material over parent bedrock; typically Dewey and Decatur soils containing concentrations of angular blocks of secondary chert. One such concentration exposed in the well of the Arsenal dump drainage canal (west of the study area) was 20 meters (65 feet) across at its base. Chert masses were encountered in digging many of the backhoe trenches in these soils, usually at depths of less than two meters (6.5 feet) below the ground surface.

4) "Old Local Alluvium", a category which includes many types of soils on "the sloping fans and benches at the base of the slopes". They consist of a mixture of local alluvium and colluvium that has been washed or has sloughed from the higher adjacent slopes" (Swenson et al. 1958:12). "Alluvium" is material transported and deposited by streams; "colluvium" is transported and deposited by unchannelled rain or melt-water flowing down hillsides. Allen soils predominate in this area. Gravel lenses and sedimentary structures show that some of the parent materials of these soils were stream deposits.

5) "Young Local Alluvium" comprises soil types which generally form in the drainage swales of the uplands; members of this class in the study corridor are Abernathy, Greendale, Guthrie, Ooltewah, and Lickdale soils. Swenson et al. (1958) report that the Greendale silt loam and Ooltewah soils and their parent material (slopewash and stream deposits) occur in "drainage ways" to depths of 1.5 meters (five feet). The others typically lie in sinks and drainage heads. These soils appear to be very recent developments, perhaps modifications of material washed into swales after historic clearing of the land.

TABLE 2. SOIL SERIES OF MADISON COUNTY, ALABAMA, GROUPED ACCORDING TO TOPOGRAPHIC POSITION, AND THE PARENT ROCK AND PREDOMINANT DRAINAGE FOR EACH (Swenson et al. 1958)

Position and Parent Rock	Excessively Drained	Well Drained	Moderately Well Drained	Somewhat Poorly Drained	Poorly Drained
SOILS ON UPLANDS: High-grade limestone and old valley fill		Decatur			
High-grade limestone		Dewey			
Cherty limestone		Baxter Cookeville	Dickson (cherty) Dickson (chert free)	Lawrence	Guthrie
Very cherty limestone	Bodine				
Clayey (argillaceous) limestone		Talbott			
Very clayey (argillaceous) limestone			Colbert	Dowellton	
Sandstone (some shale)	Muskingum	Hartsells Linker			
Sandstone, Shale and Limestone			Pearman		
SOILS ON STREAM TERRACES (OLD GENERAL ALLUVIUM): Chiefly limestone, some shale and sandstone		Cumberland Etowah	Capshaw Captina Wolftever	Taft	Robertsville
Chiefly cherty limestone		Humphreys			
Chiefly clayey limestone in places some shale				Tupelo	
Sandstone and shale, some limestone			Holston	Monongahela	Tyler
Chiefly sandstone, some shale and limestone		Sequatchie			
SOILS ON OLD COLLUVIAL LAND (OLD LOCAL ALLUVIUM): Chiefly limestone		Hermitage			
Limestone, predominately cherty		Hermitage (cherty)			
Clayey limestone				Hollywood	
Sandstone and shale, some limestone		Allen Jefferson			

SOILS ON YOUNG COLLUVIAL LAND

(OLD LOCAL ALLUVIUM):					
Chiefly limestone		Hermitage			
Limestone, predominately cherty		Hermitage (cherty)			
Clayey limestone				Hollywood	
Sandstone and shale, some limestone		Allen Jefferson			
SOILS ON YOUNG COLLUVIAL LAND (YOUNG LOCAL ALLUVIUM):					
High grade limestone		Abernathy		Ooltewah	Guthrie
Cherty limestone		Greendale		Ooltewah	Guthrie
Sandstone, some shale					Lickdale
SOILS ON BOTTOMLANDS (YOUNG GENERAL ALLUVIUM):					
High-grade limestone		Huntington	Egam	Lindside	Melvin
Cherty limestone		Ennis		Lobelville	Lee
Clayey limestone					Dunning
Sandstone, shale and limestone				Hamblen	Prader
Chiefly sandstone, some shale and limestone	Bruno				

6) "Young General Alluvium", soils formed on "floodplains or nearly level areas along streams that are subject to flooding" (Swenson et al. 1958:13). Broad expanses of Melvin and Robertsville soils dominate the flat bottomland of the Huntsville Spring Branch Basin and the broad inner swale of the Tennessee River Alluvial Terrace. Although the Robertsville silt loam is placed in the "Old General Alluvium" by Swenson et al. (1958) (Table 3), its geomorphic association with Melvin soils seems to justify its inclusion in the same category (see also below "Huntsville Spring Branch Basin"). Lindside and other soils are minor members of this group.

Figure 11 shows an example of interpretation made using these groupings.

As a result of the map analysis and field survey, it is concluded that:

1) bedrock and soils derived from in situ weathering of bedrock occur over most of the study area. These areas have been subject to erosion, accelerated since the clearing of the land for agriculture. Swenson et al. (1958) report that most of their upland and "older terrace" soils have lost portions of their "A" and "B" horizons.

2) there is little or no correlation between "Old Local Alluvium" soils and any identifiable past drainage system, much less the present stream pattern. For example, two large patches of Allen "colluvial" soils occupy the highest portions of the uplands west of the Boundary Canal. One cut through this material along Line Road contains fluvial cross-stratification in the gravel lenses. Parent materials of these soils must have been derived from erosion of the Cumberland Plateau escarpment when it was several kilometers west of its present position. These deposits are at least several million years old, and the landforms with which they were associated have long since been removed from the landscape.

3) despite the rapidity of erosion since agricultural clearing of the land, no chert fragments were detected in backhoe trenches in the upland drainage swales or in lower colluvial slopes (with the exception of Trench II 22-5; see below). This indicates that erosion has not proceeded far enough to reach the relatively shallow secondary chert masses on the in situ weathered terrain. Probably the form of the land and the drainage system north of the Tennessee River Alluvial Terrace is essentially as it was throughout the period of human occupation.

TABLE 3. PHYSIOGRAPHIC ASSOCIATIONS: DISTRIBUTION IN STUDY AREA*

Quad	Huntsville Spring Branch Basin	Bell Hill	Tennessee River Terrace and Bottomland	Boundary Canal Basin and Adjacent Uplands	Uplands North and East of HSBB**	Uplands South of HSBB**	Upland Tennessee River Alluvial Terraces
1	100						
2	84				16		
3	74				26		
4	100						
5	100						
6	100						
7	100						
8	100						
9	>99				<1		
10	100						
11	100						
12	100						
13	96				4		
14	100						
15	100						
16	100						
17	100						
18	39					11	
19	11			34		55	
20	27			73			
21	23			77			
22				50			
23				48		52	
24				100			
25				100			
26		7		93			
27				100			
28				100			
29		37		63			
30		93		7			
31				100			
32				100			
33		64		36			
34		100					
35				100			
36				100			
37		50		50			
38		94		6			
39				67			33
40				64			36
41				55			45
42		3		59			38
43			45				16
44			32				13
45			33				28
46			52	15			33
TOTALS	1,753	448	162	1,597	47	118	242
% of Total	(40.1)	(10.2)	(3.7)	(36.6)	(1.1)	(2.7)	(5.5)

* NOTE: All units have areas of approximately 67.24 hectares, except 44(30.75ha), 18(33.60ha), 22(33.60ha), 43(40.60ha), 45(41.0ha) and 46(70.5ha).

38		94		6			
39				67			33
40				64			36
41				55			45
42		3		59			38
43			45				16
44			32				13
45			33				28
46			52	15			33
TOTALS	1,753	448	162	1,597	47	118	242
% of Total	(40.1)	(10.2)	(3.7)	(36.6)	(1.1)	(2.7)	(5.5)

* NOTE: All units have areas of approximately 67.24 hectares, except 44(30.75ha), 18(33.60ha), 22(33.60ha), 43(40.60ha), 45(41.0ha) and 46(70.5ha).

Method: Point-counts at grid intersections; 10 x 10 grid with origin at northwest corner of each quad.

** Huntsville Spring Branch Basin

2

LEGEND for FIGURE 11.

- OUTCROP AREAS WITH VERY THIN SOILS (from 0 to 0.8 meters thick).

- SOILS DEVELOPED ON MATERIAL WEATHERED IN SITU FROM LIMESTONE BEDROCK; THIN (less than two meters thick). Colbert, Talbot and Pearman varieties.

- SOILS DEVELOPED ON MATERIAL WEATHERED IN SITU FROM LIMESTONE BEDRODK; THICK (more than two meters thick). Dewey and Decatur varieties.

- BOTTOMLAND SOILS: Melvin Silty Clay Loam (Me), Lindside Silty Clay Loam (Lk), and Robertsville Silt Loam (Ro).

FIGURE 11 EXAMPLE OF SOILS DISTRIBUTION ANALYSIS MAP.

Landforms: Definitions

In order to be useful to the geomorphologist, the archaeologist, and the statistician, a qualitative classification of landform associations and the elements which compose them should be 1) objective; 2) well-defined (so that components can be identified by different workers); and 3) transferable between maps, aerial photographs, and field observations.

Physiographic Associations: These categories (Figures 12 and 13) were defined on the geographic locations of individual major geomorphic features (uplands, basins, and river terraces). Boundaries between the associations ranged from well-defined to (rarely) arbitrary. Features of the associations are discussed in detail in succeeding sections.

Results of a map analysis of distribution of physiographic associations in the study area are presented in Table 3. First, the survey sections ("quads") were drawn on the Farley and Huntsville 7.5-minute topographic maps. Then, using a gridded template, 100 points were sampled in each of the full-sized sections, and proportionately more or fewer, as necessary, on the half and irregular sections. Physiographic associations were tabulated for the points in each section. As noted above, ambiguity exists in the boundaries of some of the sections. However, the values are probably accurate to within two or three percent.

Landform Elements: Quantitative definitions of landform elements (Table 4) are more subjective than a taxonomy based on measurements of length, width, local relief, and slope. However, they have proven recognizable by archaeological field crews, and their presence or absence at or near a site can be statistically manipulated to give useful results. Figures 14 and 15 shows the appearance of some landform elements on the Arsenal base maps. The table includes only definitions of the medium to small scale features recognizable on maps or in the field. Other geomorphologic and related variables were also used in this study, and these are listed in subsequent sections.

Summary of Archaeogeologic Applications

Results of Deep Testing

The location of both backhoe trenches and other profiles are shown on Figures 16 and 17. Summaries of backhoe trench/landform element relationships are presented in Tables 5 and 6. The tables show that only enough upland ridge crests and upper slope areas (four trenches: I 28-3, I 25-4, I 25-2, and I 28-7) were tested to confirm that they are and have been areas of erosion, at least since historic land clearing and agriculture began. Bottomland knoll crests and slopes were dug (Trenches II 21-5, II 21-2, I 28-5) to determine whether these features are remnants of a recent floodplain which prehistoric people might have exploited. It is concluded that they are not. A

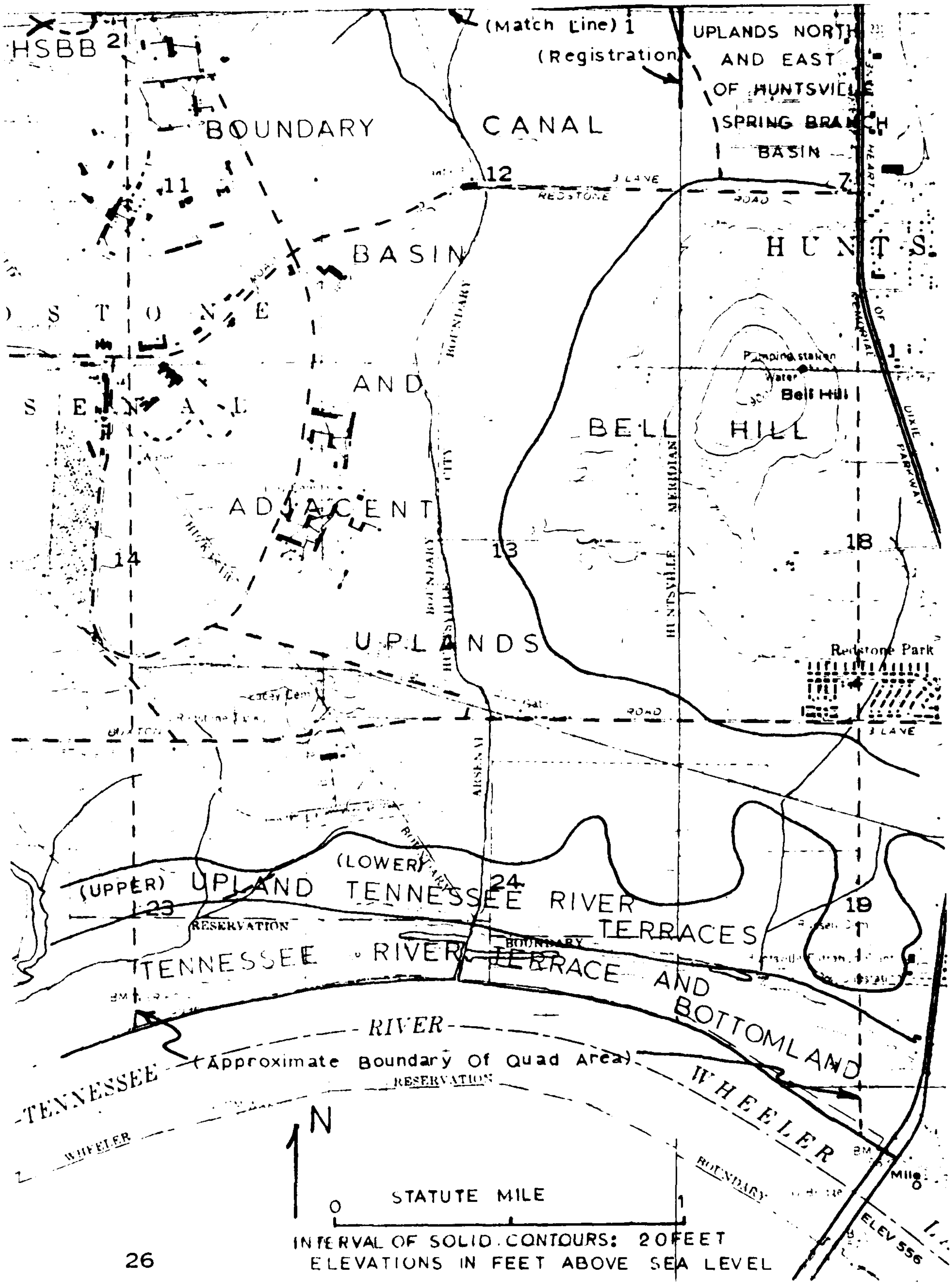


FIGURE 12 PHYSIOGRAPHIC ASSOCIATIONS (SOUTH SHEET). Base Map U.S.G.S. Farley Quadrangle 1964.

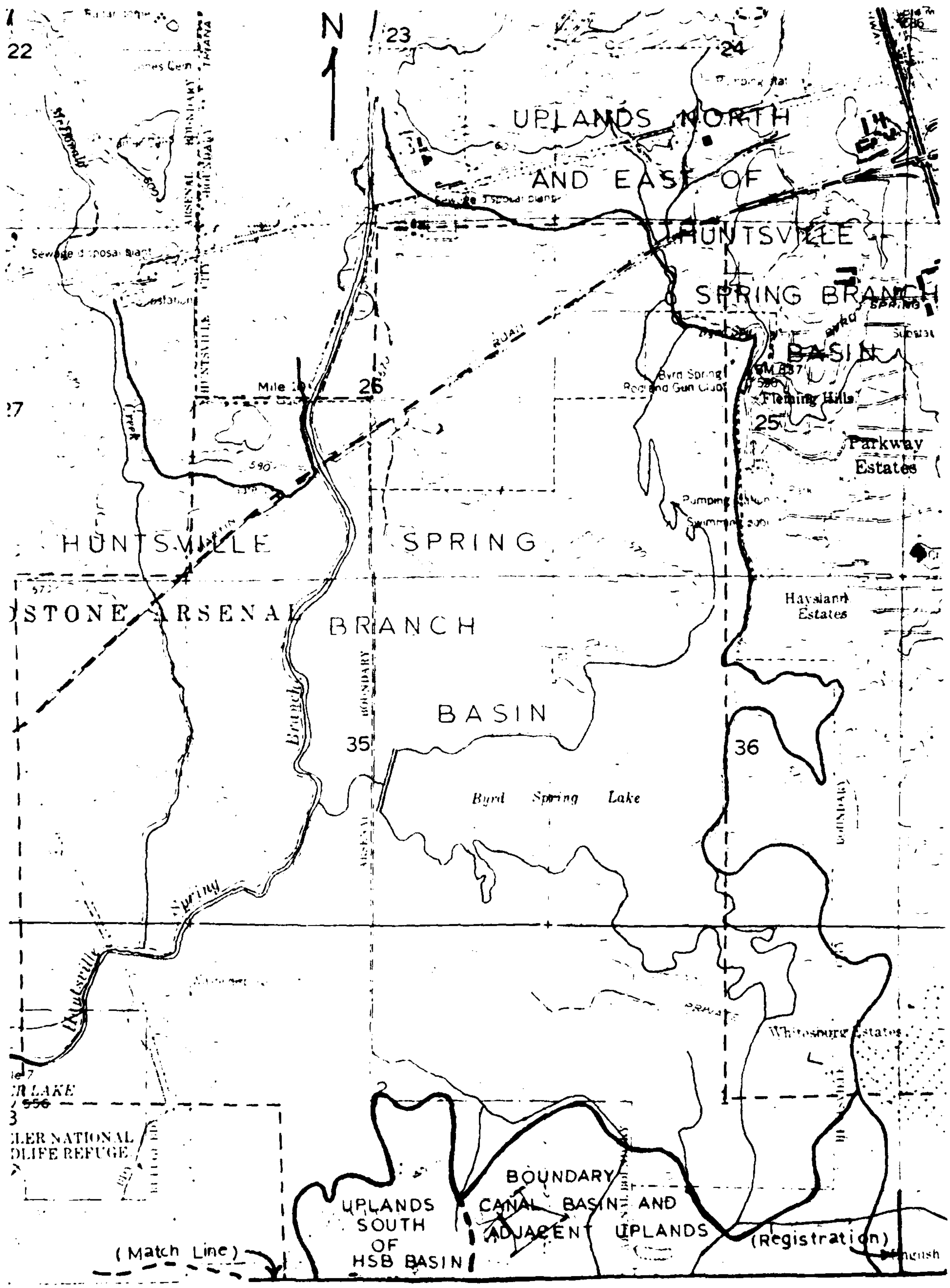


FIGURE 13. PHYSIOGRAPHIC ASSOCIATIONS (NORTH SHEET). Base Map U.S.G.S. Huntsville Quadrangle 1975.

TABLE 4. DEFINITIONS OF LANDFORM ELEMENTS

Ridge Crest: the highest part of a (usually elongated in this area) hill; also "hill crest", "hill summit".

Upper Slope (of ridge, hill or knoll): includes any gently sloping area around the crest, and/or adjacent, more steeply-sloping terrace; equivalent to erosional slope.

Lower slope (of ridge, hill or knoll): relatively gently sloping terrain at the base of a hill; equivalent to depositional or colluvial slope.

Saddle: a lower area on a hill or ridge between two crests.

Nose: elongated extension of a larger, higher ridge or hill.

Knoll on ridge, hill, nose, etc.: isolated (usually more-or-less equidimensional) hill or larger hill.

Outcrop: exposure of bedrock.

Cave or rockshelter: natural cavity in bedrock large enough to be used by humans.

Closed basin on ridge or hill (closed upland basin): depression on hill top or slope, with no surface drainage outlets leading downslope; "sink" can be used if origin as a solution feature is considered probable.

Open basin on ridge or hill (open upland basin): depression on hilltop or slope with at least one drainage outlet leading downslope; "sink" can be used if origin as a solution feature is considered probable.

Seep: an area, usually in a sink or on a lower hill slope, where water oozes from the soil; marked by distinctive vegetation in damp, boggy soil.

Drainage swale: low area extending down a hill side; the lower portion is typically marshy or wooded, with ponded or slowly-moving sheet flow in wet weather. If a well-defined natural channel is present, it is a stream valley or stream depression. Gullies are steep-banked erosional channels in cleared land.

Spring: water flowing from the ground; frequently present in basins and sinks, and on lower hill slopes.

Bottomland knoll: hill in flat, swampy terrain; can be equidimensional, or irregular, elongated, and/or connected to another knoll by a saddle, to the lower slope of a ridge, also "bottomland rise".

Bottomland: ranges in application from flat axial portions of drainage swales (with or without channels), to broad, very low relief, swampy basins.

Divide: higher ground between two streams at their juncture.

Exterior slopes at divide: slopes opposite divide at stream juncture.

Relict stream channel: cut-off portion of stream; a few are present along drainage swale or stream valley; the only examples observed in the study area lie along the Tennessee River.

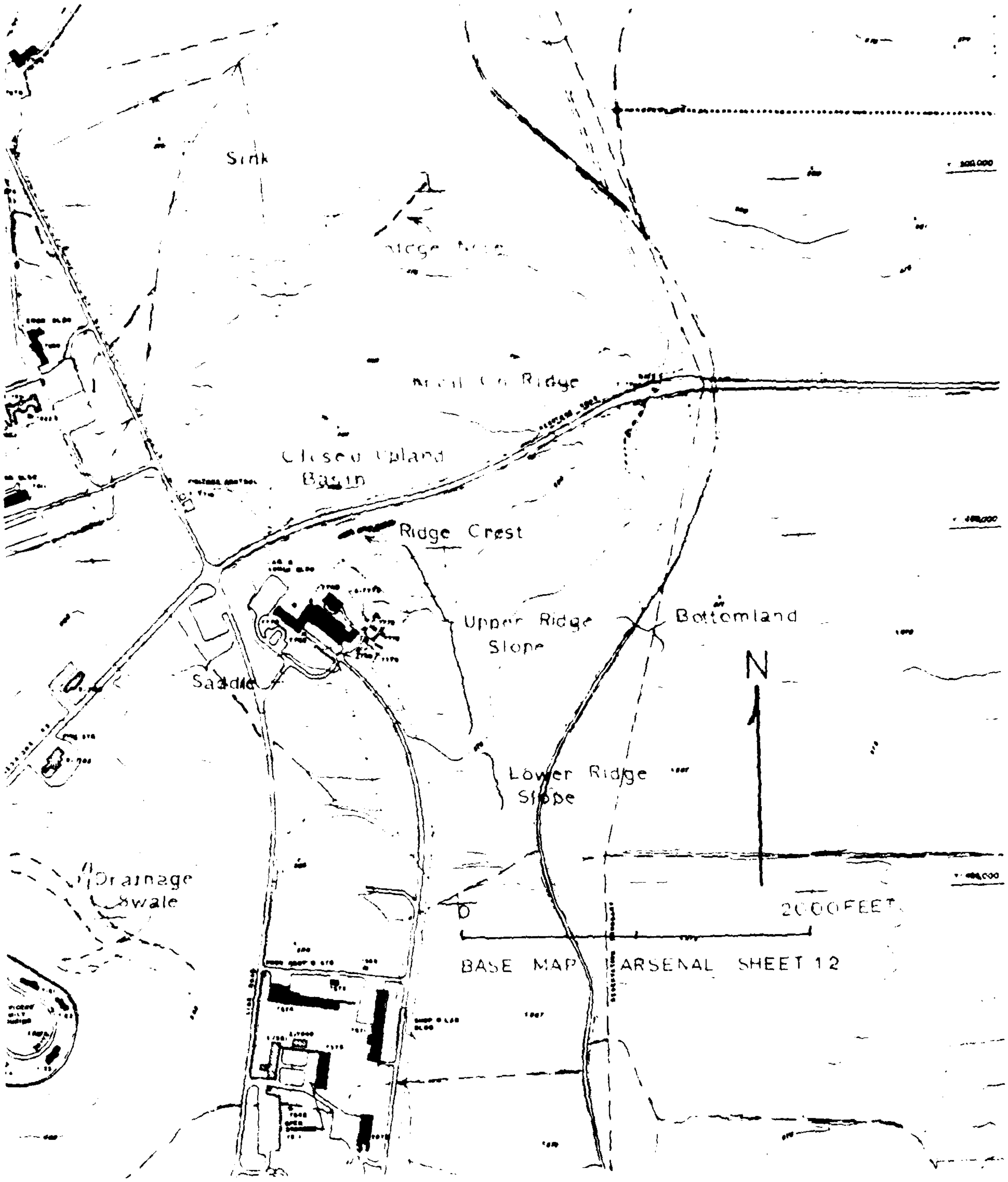


FIGURE 14. UPLAND LANDFORM ELEMENTS. Contour Interval 5 feet ASL.

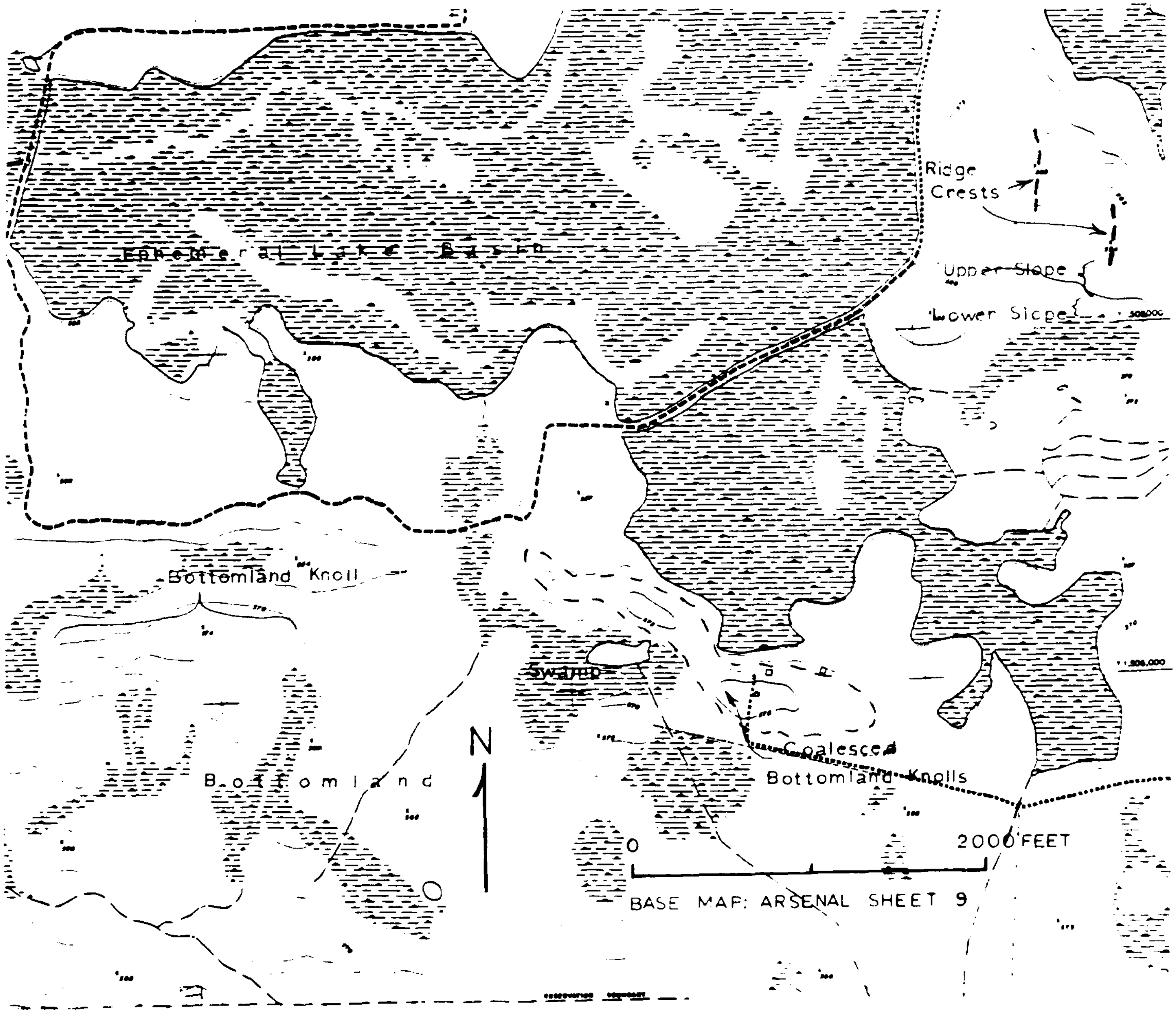


FIGURE 15. LANDFORM ELEMENTS OF MAJOR BASINS. Contour Interval 5 feet ASL.

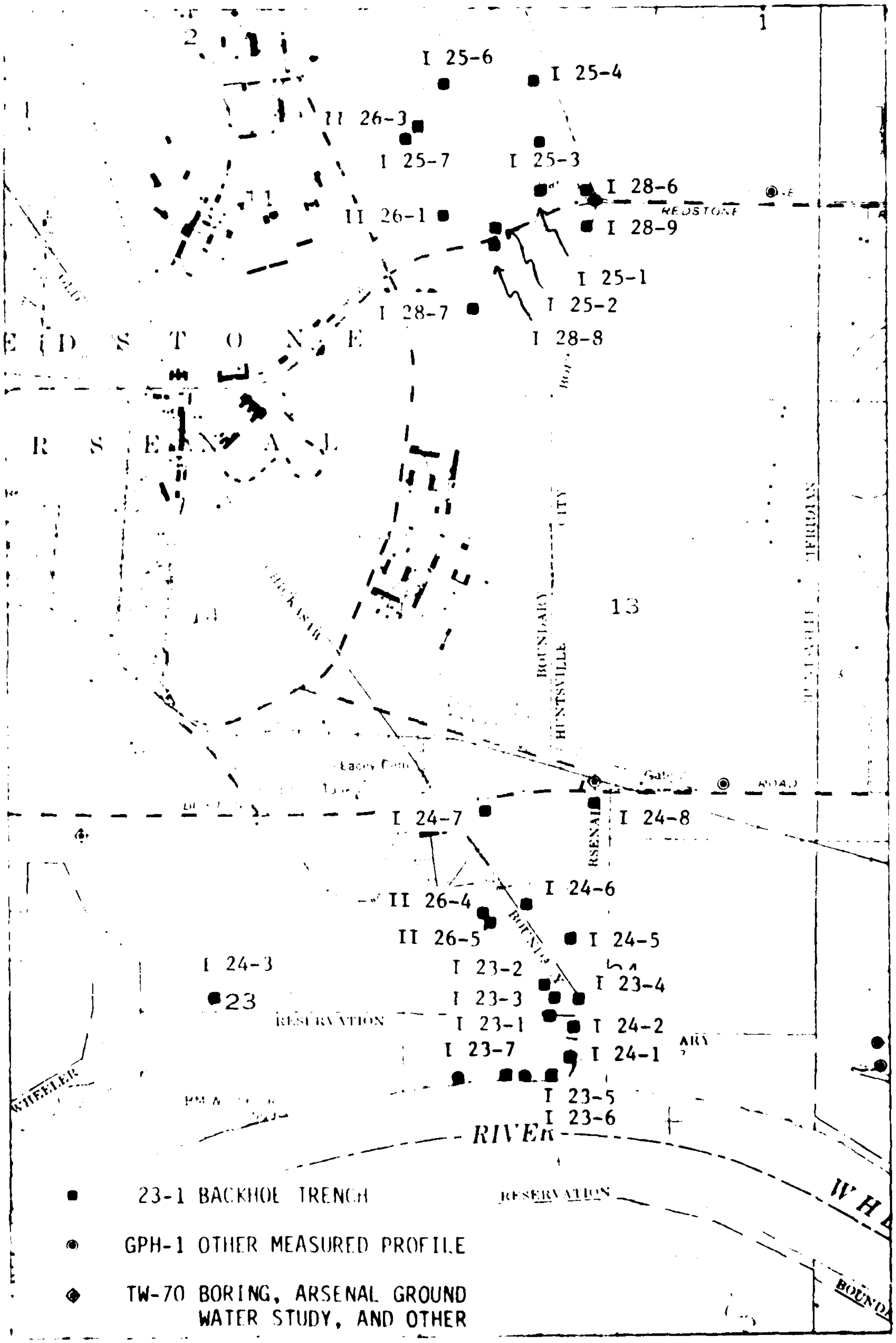


FIGURE 16. PROJECT AREA (SOUTH) SHOWING LOCATION OF BACKHOE TRENCHES AND OTHER GEOLOGIC PROFILES.

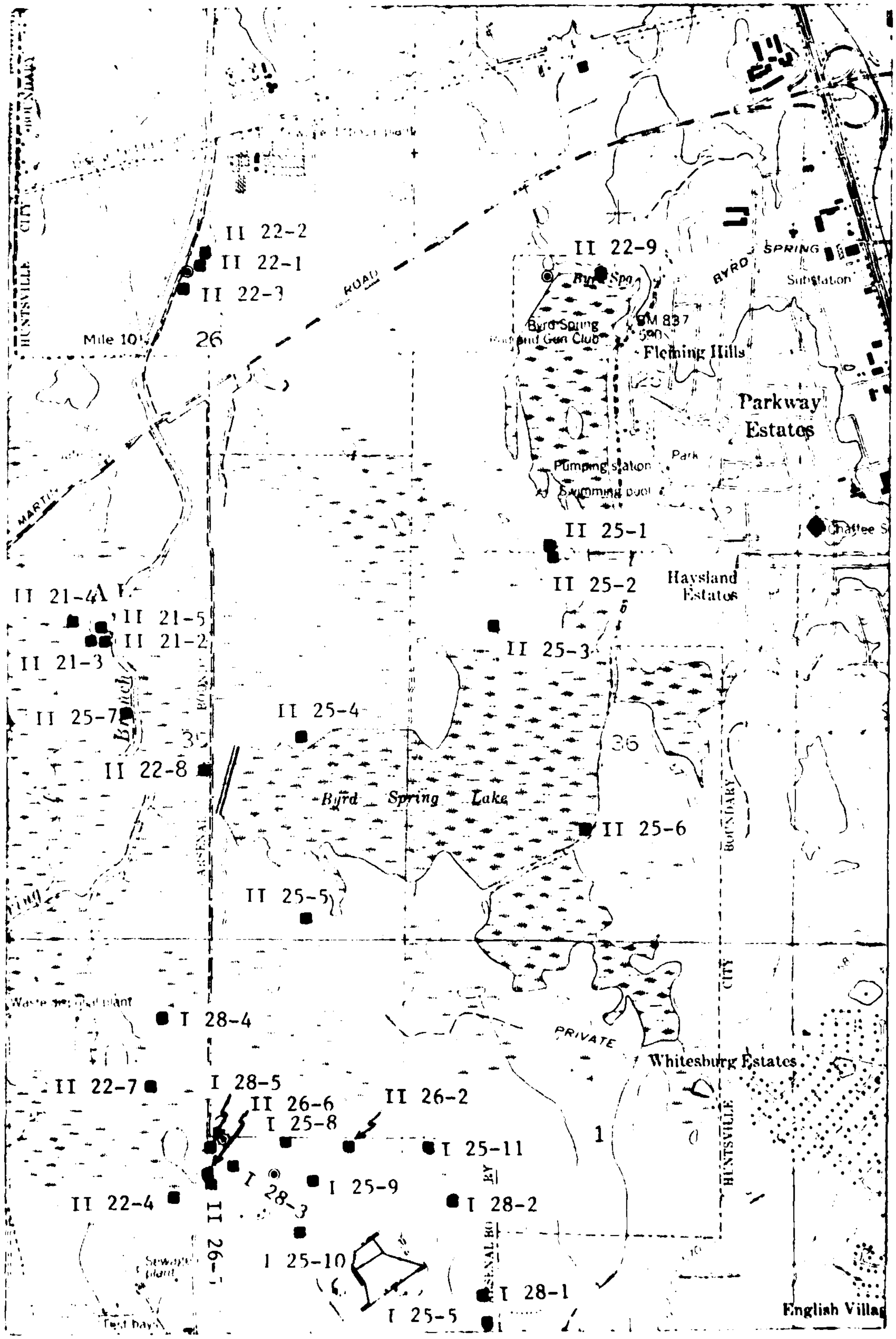


FIGURE 17. PROJECT AREA (NORTH) SHOWING LOCATION OF BACKHOE TRENCHES AND OTHER GEOLOGIC PROFILES.

TABLE 5. LOCATION OF BACKHOE TRENCHES BY LANDFORM.

Backhoe Trench	Landform Element
I 23-1	Upper rise slope
I 23-2	Open hillslope basin
I 23-3	Rise crest
I 23-4	Knoll on ridge
I 23-5	Alluvial terrace, upper slope
I 23-6	Alluvial terrace, crest
I 23-7	Alluvial terrace, crest
I 24-1	Alluvial terrace/bottomland transition
I 24-2	Lower rise slope
I 24-3	Upper rise slope
I 24-5	Upper rise slope
I 24-6	Rise slope/open hillslope basin transition
I 24-7	Rise slope/open hillslope basin transition
I 24-8	Open hillslope basin
I 25-1	Hillslope drainage swale
I 25-2	Upper slope/drainage swale transition
I 25-3	Lower slope/stream bottom transition
I 25-4	Divide
I 25-5	Lower slope/stream bottom transition
I 25-6	Lower rise slope/bottomland transition
I 25-7	Lower rise slope/bottomland transition
I 25-8	Lower rise slope
I 25-9	Lower rise slope/drainage swale transition
I 25-10	Lower rise slope/drainage swale transition
I 25-11	Lower rise slope
I 28-1	Lower rise slope/bottomland transition
I 28-2	Rim of closed basin or lower slope
I 28-3	Nose on upper slope
I 28-4	Lower rise slope
I 28-5	Lower rise slope
I 28-6	Lower rise slope/bottomland transition
I 28-7	Upper slope drainage swale divide
I 28-8	Open basin, upper rise slope
I 28-9	Lower rise slope/bottomland transition
II 21-1	Lower rise slope/bottomland transition
II 21-2	Bottomland knoll, upper slope
II 21-3	Lower rise slope/bottomland transition
II 21-4	Lower slope/bottomland transition
II 21-5	Bottomland knoll crest
II 22-1	Relict meander bank
II 22-2	Relict meander bank
II 22-3	Relict meander bank
II 22-4	Lower rise slope/bottomland transition
II 22-5	Lower rise slope
II 22-6	Lower rise slope
II 22-7	Lower rise slope/bottomland transition
II 22-8	Bottomland swamp
II 22-9	Lower rise slope/bottomland transition
II 25-1	Bottomland
II 25-2	Lower rise slope
II 25-3	Lower rise slope
II 25-4	Bottomland
II 25-5	Bottomland
II 25-6	Bottomland
II 25-7	Bottomland
II 26-1	Closed upland basin
II 26-2	Bottomland drainage swale
II 26-3	Bottomland
II 26-4	Closed upland basin
II 26-5	Closed upland basin

TABLE 6. LANDFORMS SAMPLED IN DEEP-TESTING PROGRAM.

Physiographic Association	Landform Element	Backhoe Trench
Bell Hill	Ridge crest	GPH-8*
Uplands North and East of Huntsville Spring Branch Basin	Lower (colluvial) ridge slope/ bottomland transition	II 22-9
Huntsville Spring Branch Basin	Huntsville Spring Branch bank	II 22-1, II 22-2, II 22-3, II 22-4
	Crest of bottomland knoll	II 21-5
	Upper slope of bottomland knoll	II 21-2, II 22-4
	Transition: lower slope of bottomland knoll to bottomland	II 21-1, II 21-4, II 22-7
	Bottomland	II 22-8, II 25-4, II 25-5, II 25-6, II 25-7, II 26-5
	Lower slope of bottomland knoll	II 25-2, II 25-3, I 28-4, GPH-1*
	Drainage swale between knolls	II 26-2
Uplands South of Huntsville Spring Branch Basin	Ridge nose/bottomland knoll	I 28-5
	Crest of ridge nose	I 28-3
	Lower ridge slope	I 25-8, II 22-6, II 22-5, I 25-9, I 25-10
	Upper ridge slope	GPH-2*
Boundary Canal Basin and Adjacent Uplands	Upper slope of ridge nose	I 25-1
	Divide	I 25-4
	Transition, lower ridge slope to bottomland	I 25-5, I 28-1, I 25-3, I 25-6, I 25-7, I 28-6, I 28-9
	Rim of closed basin	I 28-2
	Bottomland	I 26-3
	Open upland basin	I 24-7, I 24-6, I 28-8, I 24-8
	Closed upland basin	II 26-1, II 26-4, II 26-5
	Upper ridge slope	GPH-4*, I 25-2, GPH-9*, 12 8-7
	Hillslope drainage swale	12 5-1
	Midslope of ridge	GPH-7*
Upland Tennesee River Alluvial Terraces	Upper ridge (rise) slope	I 23-1, I 24-3, I 24-5
	Ridge (rise) crest	I 23-3
	Knoll on ridge	I 23-4
	Open upland basin	I 23-2
	Lower ridge (rise) slope	I 24-2
	Terrace margin	GPH-5*, GPH-6*
Recent Tennessee River Terrace	Alluvial terrace/bottomland transition	I 24-1
	Alluvial terrace upper slope	I 23-5
	Alluvial terrace crest	I 23-7, I 23-6
	Terrace margin	GPH-10*, GPH-11*

* Other Measured Profile

Alluvial Terraces	Ridge (rise) crest	I 23-3
	Knoll on ridge	I 23-4
	Open upland basin	I 23-2
	Lower ridge (rise) slope	I 24-2
	Terrace margin	GPH-5*, GPH-6*
Recent Tennessee River Terrace	Alluvial terrace/bottomland transition	I 24-1
	Alluvial terrace upper slope	I 23-5
	Alluvial terrace crest	I 23-7, I 23-6
	Terrace margin	GPH-10*, GPH-11*

* Other Measured Profile

2

ridge crest, upper slope, and a knoll on a ridge were trenched in the Upland Tennessee River Alluvial Terraces area, in an attempt to determine their approximate age and the possibility that these remnants of ancient floodplains might contain buried sites. Trenches include I 23-3, I 23-1, I 24-4, I 24-5, and I 23-4. It is concluded that the upper terrace floodplain predated any human occupation in the area; it is possible that the lower terrace floodplain was abandoned, and the terrace was formed by Tennessee River down-cutting and lateral erosion during Paleo-Indian and/or Early Archaic time.

All of the other backhoe trenches were dug in areas in which soils information and field observations indicated that recent deposition of colluvium or alluvium might have occurred. In short, these are areas in which buried sites might be found. Evidence of historic deposition was found in the inland areas. The colluvial and alluvial deposits are interpreted as the product of historic land clearing, which exposed the stable hill soils to erosion. No traces of prehistoric occupations were found in any of the trenches, except I 23-7 on the Tennessee River Alluvial Terrace, which encountered a stratum rich in bivalve shells that could be a midden. The investigation, supplemented by background data, concludes that probably no significant buried prehistoric sites are present in the study area, except in the Tennessee River Alluvial Terrace.

Physiographic Association, Landform, and Related Variables

In order to determine if environmental factors affected the placement of sites within the project area, a series of geomorphic and related variables were recorded for each site. The principal means of division of the project area was made by physiographic province and landform element; however, several other data were recorded (Table 7). While most of the secondary variable are self explanatory, it should be noted that the variable "Rank of nearest stream" includes a modification to the Strahler system (Figure 18); (Butzer 1976b) to include the swales in the study area in which no vestige of the natural drainage can be found. Nearly all of the natural streams have been eliminated, and drainage has been artificially channelled. Only along some portions of Huntsville Spring Branch, McDonald Creek, and perhaps in a few upland valleys, are traces of natural stream courses and other drainage patterns preserved. Consequently, the Strahler ordinal classification was enlarged to include the dendritically-patterned drainage swales, whether or not they contain a stream channel.

The following are detailed discussions of each of the major physiographic zones within the project area. The site descriptions presented in Chapter 8 are also organized by the physiographic zone into which they fall.

Bell Hill

Landforms: Bell Hill comprises a roughly conical mass, a short ridge which extends south from it, and the more gentle slopes around the bases of the first two (Figure 11). The hill exhibits relatively

TABLE 7. GEOMORPHIC AND RELATED VARIABLES.

Elevation at site

Mean Slope at site

Rank of nearest stream or drainage swale (Strahler System)

Present condition of nearest stream or drainage swale

Distance to nearest stream or drainage swale

Rank of next nearest stream or drainage swale

Present condition of next nearest stream or drainage swale

Distance to next nearest stream or drainage swale

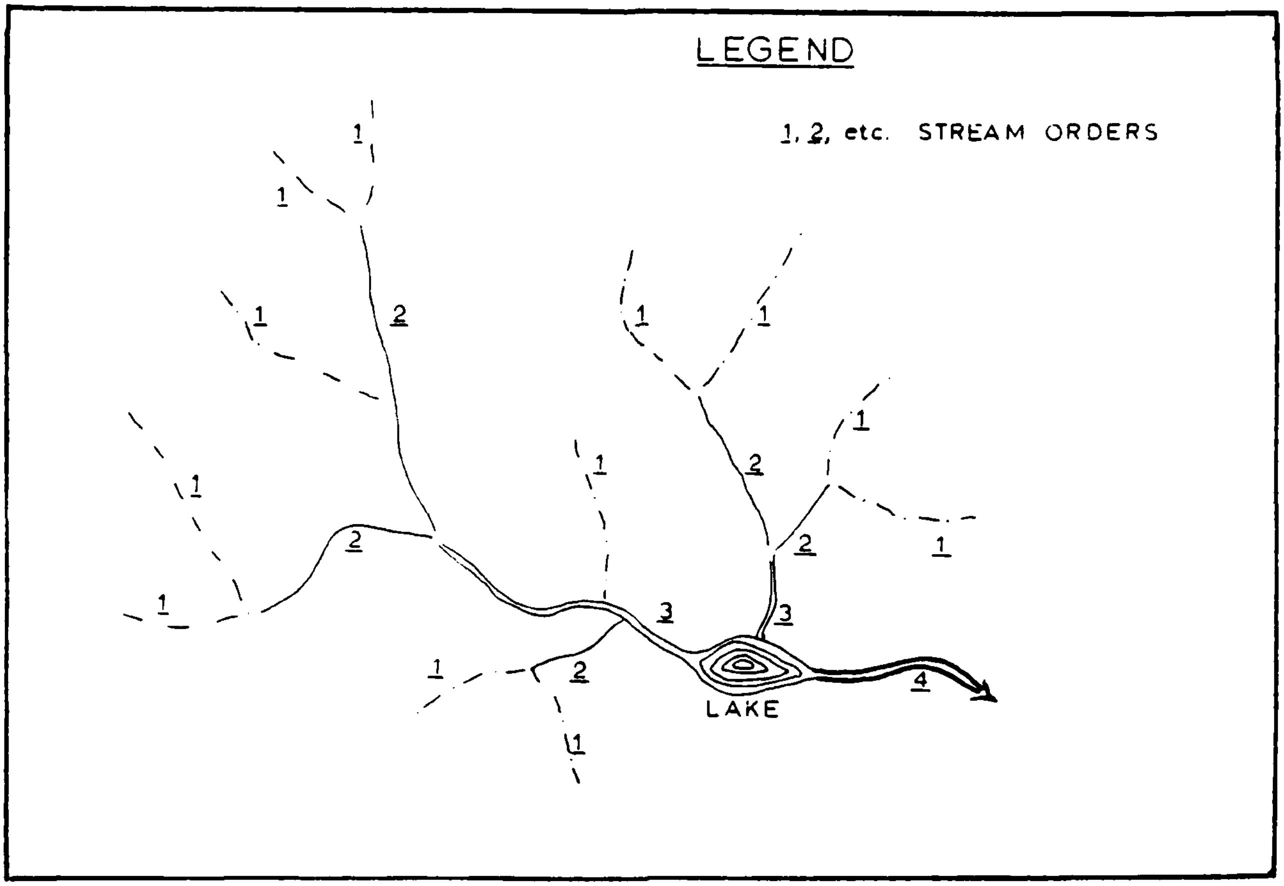
Nearest present source of water:
- Ephemeral stream
- Permanent stream
- Spring
- Swamp
- Well
- Undetermined

Next nearest present source of water:
- Ephemeral stream
- Permanent stream
- Spring
- Swamp
- Well
- Undetermined

Slope aspect (orientation of nearest slope) below site

Slope aspect (orientation of nearest slope) above site

Elevation above nearest present water site



Notes: A.) The first-order streams (ephemeral or perennial) of a drainage system are the smallest channels with well-defined banks, or the highest detectable drainage swales.

B.) The juncture of two streams of equal rank gives rise to a stream of the next higher order (2nd, 3rd, and 4th order streams)

FIGURE 18 STRAHLER SYSTEM (modified) OF RANKING STREAMS

steep slopes: low-relief, nearly flat-topped portions of the Boundary Canal Basin and Upland Tennessee River Terraces adjoin the western and southern portions of the hill. On the northern side, a low rise connects Bell Hill to the upland ridge east of Byrd Spring Lake (see "Uplands North and East of Huntsville Spring Branch Basin"). The eastern side grades into a narrow saddle between the hill and Little Farley Mountain.

The main hill rises to elevations slightly above 280 meters (920 feet) ASL, and elevations on the extended ridge decrease to the south from approximately 238 meters (780 feet) to 213 meters (700 feet) ASL. Elevation of the slope change at the base of the hill is approximately 189 meters (620 feet) ASL.

Materials: As noted above, Bell Hill is an outlier of the Cumberland Plateau strata. As such, it contains the only exposures in the study area of formations above the Tuscumbia limestone (see above "Geology, Figure 10 and Table 1). These include (from bottom to top) the Ste. Genevieve limestone, Gasper formation, Hartselle sandstone, and Bangor limestone. The lower boundary of the Ste. Genevieve limestone coincides approximately with the slope change at the base of the hill.

The cone and ridge exhibit extensive outcrop areas with patches of rocky soil between and within outcrops. No rock shelters or caves were detected. Although the limestones are jointed, blocks do not appear to have been undermined and shifted downhill, and no topographic evidence of landslips was observed. Sandstone and shale fragments are rare below the Ste. Genevieve limestone outcrop belt. Apparently, larger pieces are generally trapped by the Ste. Genevieve outcrops, and weathering rapidly reduces them to constituent sand, silt, and clay. The more gentle, surrounding slopes on the Tuscumbia limestone contain abundant secondary chert in relatively thin, but continuous soils.

Drainage: On the northern and western sides of Bell Hill, only one relatively well-defined drainage swale (on the southwestern side) extends up the lower hill slope. A restricted drainage system between the southeastern side of Bell Hill and the eastern side of Little Farley Mountain probably once held a third order, southward-flowing stream, directly tributary to the Tennessee River. In addition to these, several other drainage swales on the lower slopes could have contained channels of ephemeral streams, but have been greatly modified by historic agriculture, and no evidence of prehistoric channels remains. It seems likely that the high porosity and permeability of Bell Hill rocks, especially the presence of solution channels in the limestone, cause most of the rain and meltwater to pass into and through the soil and bedrock of the hill, down to the water table. Permanent springs were probably never present during human occupation of the area.

Uplands North and East of Huntsville Spring Branch Basin

Landforms: A low, narrow ridge extends north from Bell Hill, to (and beyond) the limit of the study corridor (Figures 12 and 13). Elevations on the discontinuous crest of this ridge rise from slightly above 177 meters (580 feet) ASL just north of Bell Hill to more than 207 meters (680 feet) ASL at Byrd Spring. Broadest parts of the ridge are less than one kilometer (0.6 miles) wide. Slopes around Byrd Spring reach 30 percent (locally higher on outcrops), but most of the ridge exhibits maximum slopes of four to five percent.

Outside of the study area, a northeast/southwest-trending spur of this ridge bounds the northeastern portion of the Huntsville Spring Branch Basin. This spur is more than one kilometer (0.6 miles) wide and is two kilometers (1.2 miles) long. It rises to elevations above 220 meters (720 feet) ASL.

Materials: Tuscumbia limestone bedrock crops out around Byrd Spring and on the slopes of the northern spur. Although Malmberg and Sanford (1963) did not map Ste. Genevieve limestone caps on either ridge crest, the formation could be present on the knob above Byrd Spring, and on the crest of the northern spur. Outcrop areas contain and are separated by patches of thin, less than 0.3 m (one foot) thick soils which contain angular blocks and smaller pieces of limestone. At Byrd Spring, primary chert fragments were found in the hillside soils, but no nodules were observed in nearby limestone outcrops. Primary chert nodules up to 15 to 20 centimeters (5.9 to 7.8 inches) across were found in exposures in the Martin Road cut, on the lower slope of the spur. This chert was dense, white to tan, and brittle.

Around the outcrops and soil patches are areas of clayey soils less than two meters (6.5 feet) thick, which formed on products of in situ weathering of the Tuscumbia limestone. Weathering profiles are thinnest on the spur around Byrd Spring and adjacent to the northern portion of Byrd Spring Lake. Between the knoll at Byrd Spring and Bell Hill, the hills of the rolling upland are formed on thick (greater than two meters (6.5 feet)) reddish, clayey soils, also developed on the in situ weathered mantle of the Tuscumbia limestone.

Internally, the hills contain masses of secondary chert. The masses comprise angular blocks up to 30 centimeters (11.8 inches) across (maximum linear dimension). Blocks are porous, and surfaces crumble and powder readily. Some surfaces are stained black, apparently by iron-manganese compounds. Upper edges of secondary chert masses commonly lie within one to two meters of the ground surface, and extend to unknown depths. From the main masses toward the ground surface, chert pieces decrease sharply in size and abundance, and increase in degree of weathering. Secondary chert blocks in good condition are rare in the upper portions of soil profiles in deeply-weathered bedrock; however, they are present on plowed hillslopes, especially those around Bell Hill and other ridges. Under natural conditions, secondary chert is probably formed in the lower

portion of the weathering profile and removed from the upper portion at roughly equal rates. So long as hills are very gradually reduced, large secondary chert blocks are probably very rarely exposed.

Between the hills, the upland drainage swales are marked by the distribution of "Young Local Alluvium" (Swenson et al. 1958), principally the Abernathy soils. None of the drainage swales in the study area could be tested to bedrock using the backhoe (Swenson et al. 1958:13-16; depth is reported as greater than eight feet). As a result, it is not possible to attempt to determine the prehistoric balance in the swales between erosion by streams and down-weathering under the influence of water table. As much as 0.5 to 0.75 meters (two to 2.5 feet) of soil from historic erosion has been found in some upland drainage swales (Swenson et al. 1958:16).

Drainage: Except for the spur ridge north of Huntsville Spring Branch Basin, the drainage is generally west, from the slopes of the chain of low mountains north of Little Farley Mountain, across the upland, and into the Huntsville Spring Branch Basin. The higher sections (along Byrd Spring Lake, around Byrd Spring, and the spur) contain sinks and caves.

The cave 61 meters (200 feet) north of Byrd Spring (Jones and Varnadoe 1968:156) is described as trending north-south with a "collapse entrance" in the side. Their map indicates that the floor of the cave slopes steeply and that the horizontal cross-section is some 2.4 meters (eight feet) wide. They report a small stream at the cave bottom. It appears that the cave is a narrow solution feature along a joint plane, at approximately 45° to vertical. No rooms were found within 40 meters (130 feet) north, or 12 meters (40 feet) south of the entrance. Several other caves are present on Weatherby Mountain (approximately 2.5 kilometers (four miles), east of the southern end of Byrd Spring Lake).

As noted above, it is difficult to estimate the form and activity of prehistoric streams in the study area. It seems likely that at least some of the streams draining the low mountains to the east could have maintained well-defined channels. Drainage which began in the lower uplands might have been through swales in which poorly-defined, discontinuous channels were present. During dry seasons, the upland swales probably contained only a series of shallow pools and boggy patches.

Huntsville Spring Branch Basin

Landforms: This wet lowland covers most of the northern two-fifths of the study area (Figures 12 and 13). In general, it comprises areally approximately 90 percent flat, swampy bottomland, and 10 percent low rises (bottomland knolls). The knolls occur as isolated, slightly elongated lumps, or in irregular, coalesced groups. Coalesced knolls blend into the lower slopes of the uplands which border the basin. Byrd Spring Lake is the eastern portion of the basin, and

in this report is treated as a sub-basin. The Byrd Spring Lake basin is almost completely surrounded by uplands and knolls. At its southwestern end, a broad swale formerly allowed surface water free passage to Huntsville Spring Branch; however, this swale was artificially dammed, forming the ephemeral lake.

Knollcrests lie three meters (10 feet) to 3.5 meters (11.5 feet) higher than adjacent bottomland, except for the one hill which contains archaeological site 1Ma133 and two other knolls near Keyhole Lake (Figure 19). At site 1Ma133, the crest is slightly more than four meters (13 feet) higher than the swamp to the west, and more than five meters (16.5 feet) higher than the bank of Huntsville Spring Branch to the east. The other relatively high knolls do not appear to contain archaeological sites. Highest elevations at these are approximately five meters (16.5 feet) greater than those of the adjacent bottomland.

Lower portions of bottomland knolls typically exhibit slopes of three to five percent. Slopes decrease toward the gently-rounded crests. The 1Ma133 knoll and several others have local slopes of ten percent.

Even the flat bottomland contains systematic elevation differences (and these correlate with soil type differences; see below and Figure 19). The wet, swampy bottom of Byrd Spring Lake Basin and the McDonald Creek and Huntsville Spring Branch portions of the broader basin lie nearly one meter (approximately three feet) lower than broad areas west and south of the Byrd Spring Lake Basin. These elevation differences could be significant to interpretation of the recent geomorphic history of the basin (see previous "Geomorphic History of the Study Area").

McDonald Creek and Huntsville Spring Branch, in the northwestern portion of the study area, exhibit gently winding channels. Several centimeters of elevation separates bank tops from adjacent swamps. Huntsville Spring Branch has been channelled throughout its length, but some artificially cut-off meanders are preserved (Figure 13).

Materials: There are no bedrock exposures in the basin; however, it is known to be Tuscumbia formation limestone (Malmberg and Sanford 1963). Soils of the bottomland knolls (including Etowah, Captina, Capshaw, Taft, and Tupelo varieties) are classed by Swenson et al. (1958:10) as "Soils on stream terraces (Old General Alluvium)". They state that:

> The rivers and streams flowed at considerably higher levels in the past, and at these levels they deposited gravel, sand and clay on their floodplains...New floodplains were formed at lower levels but remnants of the the older high-lying floodplains remained (Swenson et al. 1958:10)

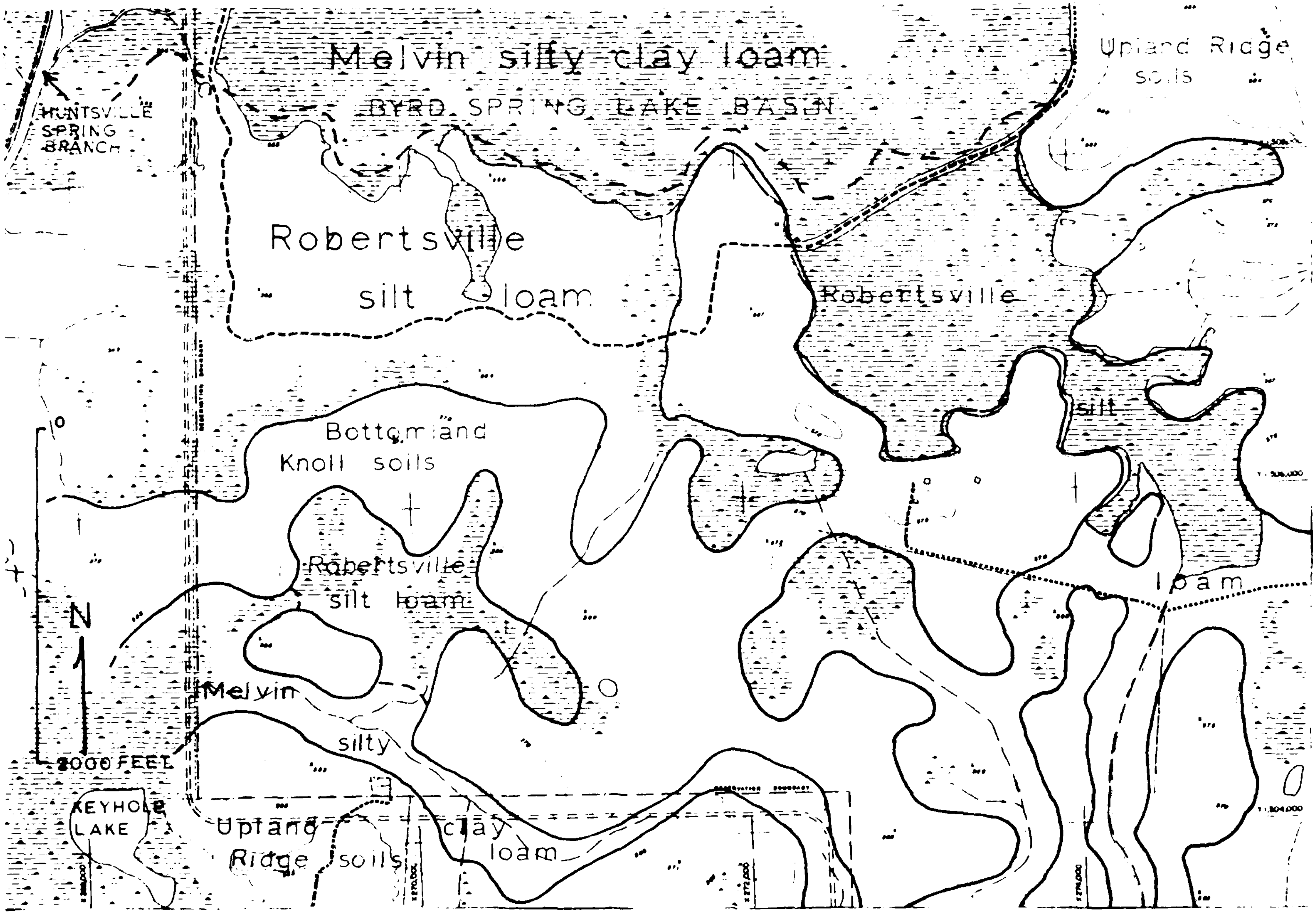


FIGURE 19. SOILS AND TOPOGRAPHY, HUNTSVILLE SPRING BRANCH BASIN. Base Map: Arsenal Sheet 9; Contour Interval 5 Feet.

The soil maps of Madison County show that these soils and the other "Old General Alluvium soils" rarely occur as coherent groups which can be traced along valley sides. Instead, they are patchy, heavily dissected, and show no relation to recent stream courses. In broader valleys such as the Flint River Valley, these soils occur on dissected remnants of obliterated terraces, surrounded by much lower, broader, and more recently formed terrace and floodplain levels.

Backhoe trenches in several knolls (Tables 5 and 6) produced evidence that these soils, at least in the Huntsville Spring Branch Basin, were probably not developed on fluvial terraces. Secondary chert was found to form the thinly-covered core of the 1Ma133 hill. It is also present near the ground surface in the knolls north of "Keyhole Lake", and in the lower-relief knolls west of Byrd Spring Lake Basin. In all of these hills, small, decomposing secondary chert pieces occur in the silty clay soils no deeper than one-half meter (1.5 feet) below the surface. The chert increases downward in abundance, piece size, and density. Upper edges of masses of unweathered (for secondary chert), angular chert blocks lie between one meter (three feet) and two meters (6.5 feet) down. Chert blocks make up 30 to 50 percent of the material at the bottom of each cut. Silty clay or clayey soil matrix formed the remainder. In sum, subsurface investigation of bottomland knolls showed the same pattern of secondary chert occurrence in the weathering profiles as did hills in the uplands. In both classes of hills, the secondary chert masses have clearly not been transported.

Drainage swales between knolls and the broader bottomlands contain Melvin silty clay loam, Robertsville silt loam, and (along the northern portion of Huntsville Spring Branch) Lindside silty clay loam. Trenches in bottomland Melvin and Robertsville soils showed evidence of a relatively recent, heavy influx of sediment, which could represent the effects of historic land clearing. For example, in Trench II 25-5, in Robertsville terrain south of Byrd Spring Lake Basin, the section comprised an upper zone 37 centimeters (14 inches) thick, transitional from silty clay down to silt loam (this zone was faintly mottled and tree roots and other roots were concentrated at its base), and a lower zone of stiff silty clay to silty clay loam with roots in the upper portion, heavier mottling, and some decaying chert fragments (it was not possible to determine whether the chert was primary or secondary). It appears that this portion of the bottomland has recently accumulated a layer of sediment slightly coarser than that of the lower zone.

Deposits with alluvial stratification were observed only along relict channels of Huntsville Spring Branch, west of archaeological sites 1Ma180 and 1Ma181. The very slightly expressed natural levees that border the channel contain alternations of clay loam and silty clay loam in layers from a few centimeters to 30 centimeters (one foot) thick. However, the layers are not traceable over distances of more than a few meters or beyond depths of two meters (6.5 feet), and they were not detected in the trench.

Drainage: Huntsville Spring Branch originates at a large, active spring in the city of Huntsville (LaMoreaux et al. 1950:32 note that the spring flow at that time ranged betweeen three and 26 million gallons per day). It also receives tributaries which drain the surrounding upland rim, including McDonald Creek. Byrd Spring, another major permanent spring, provides constant discharge to the branch through the lake basin.

Many of the features of the basin appear to be related to solution channels in the limestone. The irregular outline of Byrd Spring Lake, the bordering knolls, its assocation with the spring, and the narrow, permanent lake (clear of trees on even the 1937 aerial photographs) at the base of the ridge all suggest that the entire basin is a coalesced collapse feature. Keyhole Lake also appears to overlie a collapsed portion of a subsurface channel. Huntsville Spring Branch Basin itself is probably the result of limestone solution and collapse. The westward exit of the branch from its drainage basin to the juncture with Indian Creek was probably initiated early in its history. Diversion of the ancestral stream into a subsurface or collapsed channel would explain its passage through the upland rim.

Erosion and Alluviation in the Basin: One of the by-products of the deep-testing program was a chance to look for stratigraphic evidence of climate or other changes. It was considered at least likely that erosion during the period of historic agriculture would have resulted in deposition of a relatively thick, identifiable layer of somewhat coarse material in the basin. This view is an extension of Rube's (1975:219) investigation of soils in a restricted bog basin:

> "Peats reflect times of hillslope stability, when organic matter accumulated in the bog faster than mineral sediment from the boundary hillslopes. Bog silts reflect times of hillslope instability."

Both bottomland soils, and colluvium at the base of the ridge at Byrd Spring and the ridge east of Keyhole Lake contained stratification that supported this interpretation. In these areas, Trenches II 25-5, II 22-9, II 22-5, and II 22-6 exposed sections of coarser material (silty clay to clayey silt) over less-silty, stiffer root-rich clay.

Relict banks of Huntsville Spring Branch also showed that some probably recent channel shifting has occurred. Unfortunately, this channel has been so modified by historic human activity that little useful information about its natural state can be obtained. One of the most interesting and frustrating relict features of the branch is the embayed knoll on which site 1Ma180 is located. The arcuate cutbank might have been present before the prehistoric occupation, or it might have been formed afterward, removing a portion of the site. Stratigraphic evidence that might resolve the relationships of the branch and the site has been obliterated by historic earth moving and agriculture. The channel which eroded the arc has been buried.

Evidence of older erosional or depositional changes was also sought in the topographic and deep-testing data. The bottomland profiles show only continuous sections of silty clay, with mottling and abundance of iron-manganese concretions increasing downward. No features were detected which offer any clue to the events in the late Quaternary history of the basin. The generally concordant crests of bottomland knolls and the two levels of bottomland soils seem likely to be related to episodes of base level towering. During times of downcutting by the Tennessee River, erosion and solution channel collapse should have increased. When Tennessee River base level was stable, deposition probably prevailed. Unfortunately, the erosional and depositional effects of Pliocene, Pleistocene, and Holocene tectonic, climatic, and base level changes are not easily differentiated when no vertebrate fossils, plant remains, or archaeological materials are present in or on sedimentary deposits.

Boundary Canal Basin and Adjacent Uplands

Landforms: The upland west of the Boundary Canal Basin was divided into two association categories: one included with the Boundary Canal Basin, and one termed "Uplands South of Huntsville Spring Branch Basin" because of its association with a broad expanse of the basin bottomland, including "Keyhole Lake". Apart from a difference in adjacent lowland terrain, the two areas of upland are parts of the same ridge complex and will be described as such in this section.

The upland west of the Boundary Canal comprises a sprawling central ridge, elongated north-south, three much smaller ridges at its southern end, three smaller ridges around its northeastern side and northern end, the intervening swales and saddles, and some minor spurs with low knolls (Figures 12 and 13). Elevations on the central ridge are generally above 187 meters (615 feet) ASL, except for a trough at the southern end which has axial elevations between 186 meters (610 feet) and 185 meters (606 feet) ASL. Highest points on the crest lie between 189 meters (620 feet) and 191 meters (626 feet) ASL. Highest parts of the adjacent ridges to the south have elevations between 184 meters (605 feet) ASL and 187.8 meters (616 feet) ASL. The northeastern and northern ridges are lower, with maximum elevations between 178 meters (585 feet) and 181 meters (595 feet) ASL. Swales and troughs that divide the crests have floors three to five meters (10 to 16 feet) lower than adjacent hilltops. Maximum local relief, between the central ridge crests and the Boundary Canal bottomland, is approximately 24 meters (80 feet).

Two large elongated sinks embay the northern and northeastern sides of the ridge complex. The northern one is 100 meters (330 feet) wide and opens into the Huntsville Spring Branch Basin. At the southern end of this sink-valley, a sill (a low ridge separating two basins) lies between it and another basin to the south. This other closed basin appears to be another sink which has developed along the same subsurface channel as the one to the north. The northeastern

sink, around which sites 1Ma153 through 1Ma156 were found, has apparently coalesced from subsidance into several connecting channels. It opens into the Boundary Canal Valley through a drainage swale (Figure 20).

Slopes on the ridges west of the Boundary Canal commonly range between five and 10 percent. Along central portions of ridges, slopes of 10 to 15 percent are not uncommon.

The Boundary Canal bottomland appears to slope not at all. The original elongated sink in which the Boundary Canal was dug comprised three long, shallow troughs, separated by sills which rise less than one meter (three feet) above the basin floors. Only the northern trough was open to through surface flow to the Huntsville Spring Branch Basin. Minimum elevations of the trough floors are slightly below 172 meters (565 feet) ASL. Low, small knolls rise less than one to two meters (three to seven feet) above the trough floors.

The uplands east of the Boundary Canal are lower, and the hill-slopes are generally more gentle. Principal features are 1) a broad nose which extends westward from Bell Hill, on which a knoll rises to slightly above 180 meters (590 feet) ASL; 2) a broad ridge which contains site 1Ma210 (maximum crestal elevation is slightly greater than 180 meters (590 feet) ASL; and 3) an isolated ridge with site 1Ma157 (maximum elevation is 177.7 meters or 583 feet ASL). These three are adjacent to the Boundary Canal Basin troughs, and the two northern ridges (#2 and #3 above) are separated by a narrow swale in which the bottomland lies slightly below 172.2 meters (565 feet) ASL (Figure 12).

Materials: West and east of the Boundary Canal, the ridges and hills of the northern and southern ends of the uplands are formed on material weathered in situ from Tuscumbia limestone. Surface materials include thin to thick clayey soils containing chert masses, as described above (see "Bell Hill" and "Uplands North and East of Huntsville Spring Branch Basin".)

West of the canal, soils of the northern portion of the central ridge, and much of the adjacent ridges to the south are "Old Local Alluvium" (Swenson et al. 1958:12). These soils "consist of a mixture of local alluvium and colluvium that has been washed or has sloughed from the higher lying adjacent slopes". The authors note that water-transported gravels are sometimes found in the soil profiles. A lens of such gravel was found in a road cut at the south end of Live Road, in an area mapped as "Allen fine sandy loam, eroded undulating phase". This and smaller patches of mixed alluvial and colluvial deposits must have formed on the lower slopes of the Cumberland escarpment before erosion removed it from this area.

The central portion of the upland east of the Boundary Canal and west of the northwestern side of Bell Hill is a low-relief surface formed principally on Etowah soils and the Abernathy silt loam (another "Young Local Alluvium" soil). The broad area over which

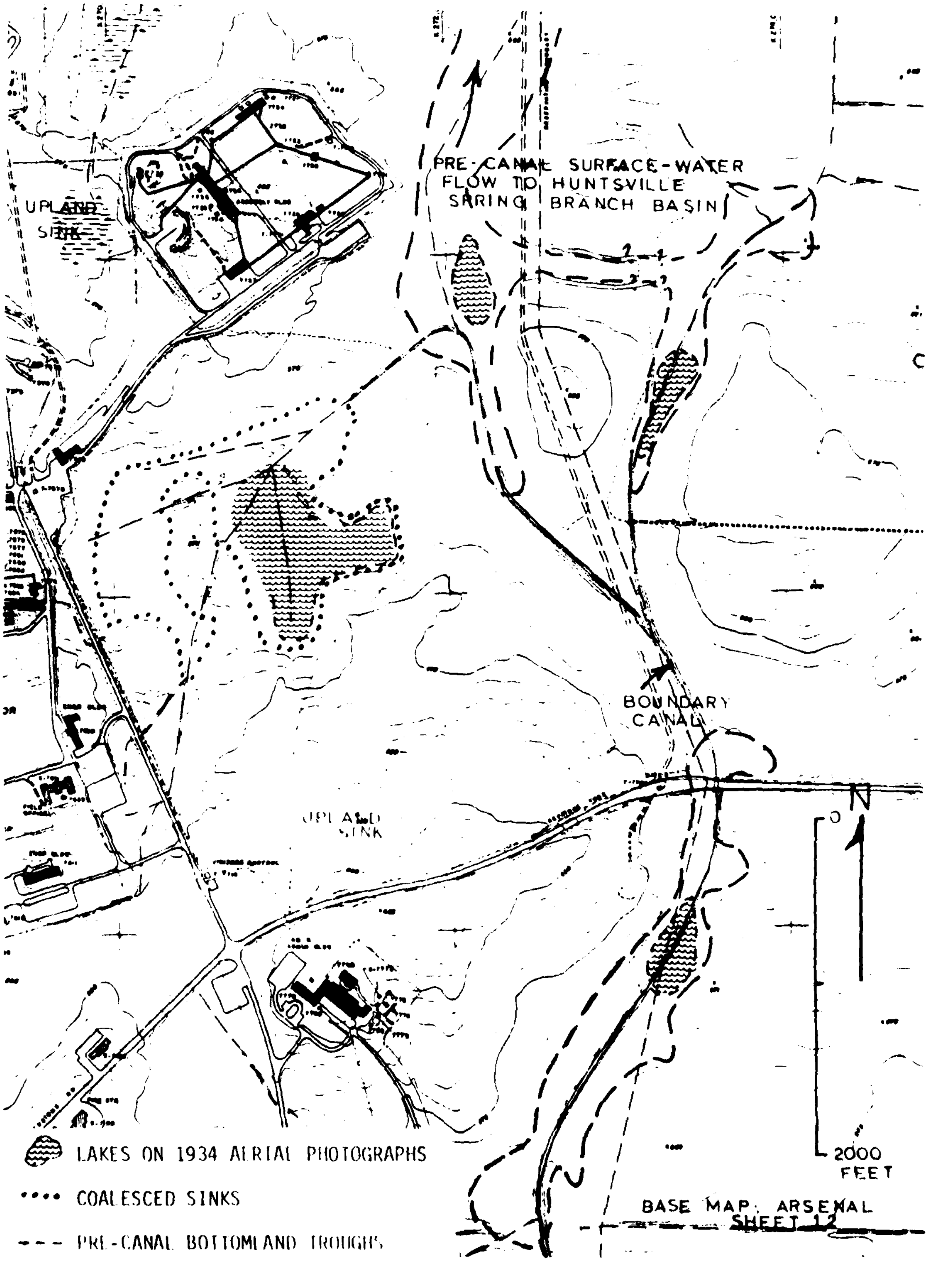


FIGURE 20. RIDGES AND SINKS OF BOUNDARY CANAL BASIN AND ADJACENT UPLANDS.

this patchwork occurs is surrounded on all sides (except for the Boundary Canal trough) by higher, older material. Apparently, the Etowah and Abernathy soils developed in a closed sink basin, possibly the precursor of the Boundary Canal trough.

Southernmost portions of the uplands include several low spurs and noses formed on a thin to thick, in situ-weathered mantle. These extensions of ridges interdigitate with portions of the Upland Tennessee River Alluvial Terraces. Bedrock crops out south of Bell Hill in a knoll which contains archaeological site 1Ma49. This knoll is interesting because of two features. One is a closed sink around the western side, which contains several small openings into the Tuscumbia limestone bedrock of the knoll. The second is the opening closest to the site; this one is some two meters (six feet) wide and presently 20 centimeters (0.6 feet) deep. From it, a passage 0.5 meters (1.6 feet) high extends into the hill. A cave might be present which would have been accessible to prehistoric humans.

Bottomland soils of the Boundary Canal Basin are Melvin silty clay loam in the north and center, one small patch of Lindside silty clay loam in the center, and Robertsville silt loam in the south. The Robertsville soil area approximately corresponds to the southernmost of the three troughs. The larger sinks connected with the Boundary Canal Basin are also floored with Melvin soils. Data from several of the backhoe trenches show the same pattern of recent (historic?) relatively course deposition at the bases of slopes. However, like the Huntsville Spring Branch Basin bottomland soils, no stratigraphic evidence of earlier environmental changes is present.

Drainage: Present drainage channels and the flow direction of the Boundary Canal are artificial. Soil distribution and topographic evidence indicate that in late prehistoric time, flow in the basin was to the north (Figure 12), and that the southern trough could have been a closed basin with subsurface discharge to the Tennessee River. Several shallow lakes present on aerial photographs taken in 1937 were probably in nearly-filled sinks. They appear to have been natural, and no evidence of beaver dams was detected.

Upland Tennessee River Alluvial Terraces

Landforms: Two relict Tennessee River alluvial terrace levels are present in the study area, sandwiched between the uplands along the Boundary Canal on the north and the lower Tennessee River alluvial terrace and bottomlands to the south (Figure 12). The upper terrace level, represented by a few hills on the western side of the study area, is heavily dissected. Two roughly concordant crests show that the original terrace surface elevation would have been approximately 176.8 meters (580 feet) to 178.3 meters (585 feet) above present sea level. More to the point, tops of the dissected hills lie some six meters (20 feet) higher than the bottomland on the lower recent terrace to the south.

The younger relict terrace level is represented by a true terrace: broad areas of low-relief terrain (highest elevations between 175 meters (574 feet) and 175.9 meters (577 feet) ASL and a well-defined, relatively steep slope down to the recent terrace bottomland four to six meters (13 to 20 feet) below the terrace top. The northern boundary is irregular in plain view and does not appear to represent erosion of the older upland by the river. It should also be noted that low ridges in the southern portion of this terrace are higher in elevation than some nearby upland terrain (including a broad swale to the north, which contains the end of one of the troughs of the pre-canal [Boundary Canal Basin]). Possible explanations for this apparent anomaly are considered below.

On the older relict terrace, slopes are moderate, five to 10 percent, except at the southern edge of the elongated hill which contains archaeological site 1Ma142. That edge is part of a long, gently arcuate cutbank, eroded into both the older and younger relict terraces, by a phase of the Tennessee River which preceded deposition of the recent alluvial terrace. Backhoe Tench I 24-3 at site 1Ma142 showed that land modification by the U.S. Army included scraping earth from the hillcrest and dumping it on the southern slope, steepening the upper hill slope to 20 percent or more. The natural slope was probably closer to 10 percent.

The younger relict terrace exhibits gentle slopes, generally less than three percent on the low-relief terrace top and five percent (locally to 10 percent) on the riverward face down to the lower recent terrace. The Boundary Canal cuts through the younger terrace in a completely artificial channel, according to the topographic and pedologic evidence. Slopes along its course are very steep. Other areas of artificial steep slopes occur in gravel pits along the southern terrace edge east of the Arsenal boundary.

Width of the lower relict terrace is comparable to that of the recent alluvial terrace and has roughly the same surface form. The relict terrace blends northward into colluvial slopes up to the upland ridges (except for the basin noted above), and rises slightly toward the terrace edge to the south. Low, broad, poorly-defined ridges (capped by archaeological sites 1Ma31/32, 1Ma33/50 and 1Ma40) occur along the terrace margin in the central and eastern portions of the study area.

Materials: Hills of the upper terrace level harbor Etowah silt loam and silty clay loam soils (Swenson et al. 1958:Plate 58). Swale floors contain the familiar gray, clayey Melvin soils. As noted above, backhoe Trench I 24-3 exposed a 27-centimeter-thick layer of made-earth (from earth moving by the Army at the Hazardous Demolition Area). Below that, the natural soil profile down another two meters (seven feet) comprise silt loam transitional down to silty clay loam, containing scattered, well-rounded sandstone pebbles. Artificially flaked chert occurs in the upper 12 centimeters (4.7 inches) of the natural section; the natural section appears to represent water-laid

deposits. However, the artifacts are much younger than the sediments and appear to have been mixed in by plowing or by passage of vehicles.

Deposits of the lower relict terrace are represented in backhoe Trenches I 23-2 and I 23-4, and in exposures in the walls of gravel pits in the terrace edge south of archaeological site 1Ma31/32. These show that the silty to sandy soils (predominantly Etowah, also Cumberland, and Sequatchie varieties) contain rounded chert and sandstone pebbles which are scattered through the upper two meters of the section. The gravel pits (for example, GPH 6, south of 1Ma31/32) expose a layer of silt loam and loam some 1.6 meters (five feet) thick, with chert and sandstone pebbles. This layer overlies a gravel stratum at least 0.5 meter (two feet) thick. Below that, a slope is formed on collapsed soil material for an additional meter (three feet) down to the bottomland of the recent Tennessee River terrace. The gravel deposits probably continue beneath the slumped material.

Drainage: Surface drainage of both the upper and lower relict terraces is via drainage swales which originate in the uplands to the north (Figure 12). Swales tend to coalesce as they cross the terraces. One short, third-order system has dissected the upper relict terrace. Most of the lower relict terrace in the study area does not exhibit well-developed surface drainage. However, the eastern portion has been moderately dissected by several tributaries to the presently channelized stream, which rises in the saddle between Bell Hill and Little Farley Mountain. The original form of some of the surface drainage might be represented in the swale east of site 1Ma142 in the older relict terrace hills. In this swale, a series of boggy pools is connected by ill-defined low areas down the length of the valley, from the swale head to its juncture with an artificial channel in another swale.

Terrace Level Ages: The upper relict terrace level represents the oldest identifiable Tennessee River floodplain. Following an episode of base-level lowering and downcutting, a floodplain (now the lower relief terrace) was constructed at a lower elevation. This floodplain (but not necessarily the terrace formed from it) obviously antedates the prehistoric occupations on its surface, specificially the Paleo-Indian and/or Early Archaic components at sites 1Ma31/32 and 1Ma33/50. The floodplain-terrace age ambiguity will be discussed below. Another episode of base level lowering and fluvial erosion produced a broadly arcuate cutbank on both the lower and upper relict terraces.

Recent Tennessee River Alluvial Terrace and Bottomland

Landforms: A north-to-south cross-section, this lowest and most recent construction of the pre-TVA Tennessee River comprises 1) an inner bottomland at the base of the degraded cutbank on the relict terraces; 2) a low-relief rise toward the river; and 3) a relatively steep cutbank down to the river (Figure 12). At both the western and eastern ends of the study area, this terrace is some 480 to 500 meters (1500 to 1650 feet) broad; in the center, it is 250 meters (800 feet)

wide. It is bounded by two broadly arcuate cutbanks, one on the north on the relict terraces, and one on the south by itself. The bottomland is continuous, and occupies 40 to 60 percent of the terrace surface.

The swampy floor of the bottomland lies slightly below 170.7 meters (560 feet) ASL (except where it is traversed by a stream or by the Boundary Canal). In relation to adjacent features, it is some nine meters (30 feet) lower than the crests of the upper relict terrace level hills, approximately five meters (16 feet) lower than the top of the lower relict terrace, and 2.5 to three meters (eight to 10 feet) lower than the low ridges of the terrace margin to the south. It is less than one meter (three feet) above the mapped water level of Wheeler Lake (formerly the Tennessee River), which appears to be approximately a mean water level for the pre-TVA river in this area.

Slopes between the bottomland and the ridges are generally less than five percent, but can locally reach 10 percent. On the cutbank along the river, slopes range from approximately 75 percent to nearly vertical.

The river cutbank locally grades downward into a lower level, a discontinuous bench which begins about two meters (6.5 feet) lower than the adjacent crest and slopes toward the river at approximately 20 percent. These benches do not appear to represent slumps, as they are not associated with detectable embayments on the upper cutbank slope or with bent tree trunks. They probably represent a bar built against the cutbank by the pre-TVA river; this bar has been largely destroyed by wave action in the Wheeler Reservoir.

Materials: Bottomland soils are poorly-drained Melvin and Lindside silty clay and clayey varieties. No stratification was detected in the quiet-water sediments of the bottomland.

Backhoe trenches in the terrace margin ridges (I 24-5, 6, and 7) and profiles of the cutbank (GPH-10 and 11) show that several layers of loam, loamy sand, and sandy loam occur down to 1.25 to two meters (four to six feet) below the ridge crests. Lenses of clam shells up to 20 centimeters thick occur in this upper zone. Below the sandy layers, the deposits are homogeneous silty clay loam to clay loam. The silty, clayey sediments in the lower zone are similar to material exposed in trenches cut in Melvin soils of the bottomland. Soils of the terrace margin ridges are Huntington silt loam and fine sandy loam, and Egan silty clay loam.

Drainage: The bottomland probably collects much of the rain and melt-water from the terrace and the rising hillslopes to the north. Wheeler Reservoir, and formerly the Tennessee River, directly control ground and surface water levels. At times of low water in the former river, a probably permanent southwest-flowing stream drained the central portion of the bottomland into the river.

Age of the Terrace: The recent terrace maintains approximately the same elevations on both sides of the pre-TVA river, from Lehman's Bluff below the study area, to the mouth of the Flint River above it. Total distance is approximately 15 kilometers (24 miles). Prehistoric sites line the terrace margins on both sides, and the margins of Hobbs Island, an elongated, broad mid-channel island several kilometers (a few miles) upstream from the study area. The recent terrace south of the river is much wider than the northern one, and it exhibits traces of several channel and bar complexes which were abandoned as the river migrated northward. No sites are reported from these interior ridges (Alexander 1979). It appears that the Tennessee River was in the position stabilized by the TVA for some time before the Middle-to-Late Archaic occupation at site 1Ma141.

In discussing ages of the relict terraces, it was noted that Paleo-Indians could have been present on low ridges of the lower relict terrace qua terrace, or in its original floodplain form. It is possible that the episode of downcutting which eroded the cutbank on the relict terraces might have occurred after the Paleo Indian occupation. During that episode, the river in this area could have migrated nearly two kilometers (one mile) to the south, then back again to the north. The Middle-to-Late Archaic occupation of terrace margin ridges (at site 1Ma141), which were formed as bars built up during high water periods, confirms that the channel was in approximately its present position prior to the occupation. If this hypothesis is correct, Paleo Indian and especially Early Archaic sites are possibly present on inner ridges of the terrace south of Wheeler Reservoir.

Potential Sources of Lithic Materials

Lithic materials, or "rocks", are present in abundance in and around the study area. Nearest sources of primary chert and other rock types have been listed for each individual site in the study area (see below). In general, potentially useful rocks are found only on or beyond the periphery of the area.

Limestone is present on the low ridge east of Byrd Spring Lake Basin and at Bell Hill, around Byrd Spring, on the ridge on the northeastern boundary of Huntsville Spring Branch Basin, and Weeden and Madkin Mountains to the northwest. Monte Sano-Huntsville-Green Mountain is also largely limestone. The Tuscumbia, Ste. Genevieve, and Bangor limestones are all available on the higher features (Figure 10), although the Tuscumbia can be covered by colluvium. Tuscumbia limestone is exposed at Byrd Spring, at archaeological site 1Ma49, and on the spur ridge north of Huntsville Spring Branch Basin.

The primary cherts associated with these formations are reported to be differentiable (Malmberg and Swenson 1963). In the Tuscumbia limestone are nodules of gray and white cherts, and, more rarely, blue-gray chert. The Ste. Genevieve limestone contains nodules of pink and gray chert. Bangor limestone black chert is found in the upper 21 meters (70 feet) of the 105 meters (350 feet)-thick section.

Consequently, black chert is probably not available on Bell Hill, Weeden Mountain, or Madkin Mountain, where only the lower portion of the Bangor limestone is present. The full thickness of Bangor limestone does crop out on Monte Sano-Huntsville-Green Mountain.

Gravel deposits are exposed in the southern margin of the lower relict Tennessee River terrace. These contain rounded quartzite and chert pebbles and cobbles, with quartzite the dominant material. Clasts which appear to be well-cemented Pottsville sandstone are also present in the gravel deposits nearer to Green Mountain.

Dark to black cherts of the Fort Payne chert formation are not accessible at the surface in or around the study area. Fort Payne nodular chert is reported to be dense and translucent, with a conchoidal fracture (Malmberg and Sanford 1963). The formation crops out on ridges in the northern part of Madison County. Terrace gravels along the upper Flint River and Limestone Creek probably contain gravel clasts of Fort Payne chert.

Rocks and minerals found at prehistoric sites in the study area (see Chapter 8), at the Flint River site (1Ma48)(Webb and DeJarnette 1948a), and at sites elsewhere in the Wheeler Basin (Webb 1939) comprise not only local varieties, but also material that must have been transported over relatively long distances, and other exotic material, which could have been either brought into the area, or possibly obtained from terrace gravels. Exotic types that must have been carried in by humans include:

1) relatively soft, metamorphic "greenstone" (usually a chloritic, schistose rock); Jones (1939:16) states that the nearest possible source for one variety (the Hillabee schist) lies nearly 150 kilometers (100 miles) southeast of the Wheeler Basin (in the Piedmont Province).

2) "steatite" (as used by archaeologists, the term refers to a miscellaneous assemblage of true steatite, serpentinite, soapstone, talc schist, chlorite schist, and other rocks "which are sufficiently soft and massive enough for the manufacture of artifacts by the aborigines", according to Jones (1939:17). This material is also found in the Piedmont, 145 to 160 kilometers (90 to 100 miles) distant from Wheeler Basin.

3) metallic minerals - galena (lead sulphide), native copper, and hematite are foreign to this area, and probably came much farther than the Appalachian Highlands. Jones (1939:19) states of galena: "The original source was unquestionably the Joplin [Missouri] district." He mentions only one criteria on which he bases the identification: the fact that galena from the western United States and Mexico is silver-bearing, whereas that of the Joplin District (and that found in the Tennessee Valley) is not. Native copper is apparently found at Ducktown, Tennessee, but Jones believes that the area

"probably did not have a sufficient amount of native copper to have supplied the demands of aboriginal craftsmen. He attributes the copper to the Keweenaw Peninsula, Upper Michigan. Webb and DeJarnette (1948a:46) note "grooved ground hematite" at the Flint River site (1Ma48). The hematite (iron oxide) source was probably exposures of Paleozoic iron formations in the southern Appalachian Highlands.

4) schist, slate and other workable, but fairly durable rocks, were formed into artifacts used by prehistoric humans at the Flint River site (1Ma48)(Webb and DeJarnette 1948a:46). These were probably also carried by humans (as boulders, blanks, or artifacts) from the Piedmont.

Jones (1939:20) lists several other hard rock types found at sites in the Wheeler Basin, including syenite, porphyritic granite, granite, basalt, and felsite. These igneous and metamorphic rocks are found in the Piedmont Province. It is possible that they could also be present in Tennessee River terrace gravels. However, quartzite is the predominant gravel rock type in the gravels.

Hydrology

Drainage systems which surround the Indian Creek-Huntsville Spring Branch drainage basin have been described above (see "Drainage Basins). The Indian Creek-Huntsville Spring Branch Basin and Boundary Canal Basin have also been reviewed in some detail. It is the purpose of the succeeding sections to summarize characteristics of the drainage system in the study area, and the relations of the system to the geomorphic features.

Surface Drainage: The Tennessee River, even in its present form, provides base level for all of the streams in the area. The pre-TVA river (prior to 1924) probably exhibited higher floods and certainly was subject to lower low-stages than the present Wheeler Lake. Records of pre-TVA flow at Florence, Alabama, approximately 93 kilometers (55 miles), west of Huntsville, for the period between September 30, 1924, and November 7, 1971, show that the river discharge (and water level) generally varied with precipitation. Tennessee River flow was lowest through mid- to end September, in October, November, and early to mid-December. Flow was greatest in January, and declined through the spring. January mean discharge was approximately 20 times that in the dry months. However, within the dry and wet seasons, flow varied by factors of four to five, reflecting local precipitation, precipitation tributary systems, rapid melting of highland snow cover, and other causes.

Although the post-TVA flood characteristics of the river are not comparable to the natural system, they probably have a marked effect on deposition in the tributary basins. This will be discussed below (see "Hydrology and Landforms"). An extensive engineering report (U.S. Army Engineers 1930) noted that the river banks, even during

floods, were generally permanent. The report also presented some interesting data on the annual discharge of suspended sediment into the Ohio River, and estimated that the total base erosion rate was approximately 0.001872 inches per year. However, as Harper (1942) notes, it was not stated whether the observations were made before or after construction of the Wilson Dam. Stability of the channel over long periods of time is demonstrated by the distribution of prehistoric sites along the alluvial terrace margins on both sides of the river, and around Hobbs Island.

Huntsville Spring Branch and its study area tributaries have been channellized throughout much of their length. Except for a few artificially cut-through meanders, the natural form of the branch has been lost. A few first-order upland drainage swales contain features that might have been typical of upland surface drainage in the past. These features comprise series of boggy pools scattered along the floors of the swales, joined by elongated depressions. No channels are present. Extension of this form to swales which contain artificial channels is partially supported by results of an analysis of a series of 1937 aerial photographs maintained by the Arsenal. The aerial photographs which included portions of the study corridor were inspected for evidence of natural stream channels. Lower limit of resolution was approximately one meter (three feet). No natural channels of that or greater bank-to-bank width were detected in the uplands. Lowland streams were either concealed by swamp vegetation, or exhibited straight sections typical of artificial channellization.

Because of the extensive historic modification of the natural drainage, it is not possible to determine whether any of the major streams were interrupted, i.e., whether flow passed into subsurface channels at some point along the course; interrupted streams are common in some limestone bedrock terrains. None of the closed hilltop or hillside basins are associated with swales that enter, but do not exit the basin. A large, coalesced sink in the uplands west of the Boundary Canal (Figure 20) receives at least one second order upland stream, and seems likely to have had no surface channel to the canal basin in prehistoric time. However, the topographic evidence is ambiguous, and artificial channels have obscured any evidence of the original form. Interrupted streams do occur in the valley between Monte Sano-Huntsville-Green Mountain and the ridge which extends north of Bell Hill, along the east side of the Byrd Spring Lake Basin.

Permanent and ephemeral lakes, with either open water or marsh vegetation, are present at several places in the study area, including the sink mentioned above (Figure 20), in "Keyhole Lake" (Figure 19) in the Huntsville Spring Branch Basin, and Byrd Spring Lake (properly, the narrow, treeless lake that extends south from the spring). In addition, three marshy ponds or lakes were present in the Boundary Canal Basin in 1934 (Figure 7), but have been filled since that time. An early map of Madison County (Mayhew 1875) shows that at least some of the lakes listed above were present in the late nineteenth century. Byrd Spring Lake is definitely shown, and four lakes in the Boundary

Canal Basin (one more than those recorded in 1937). Of the latter, only one can be identified with some assurance: a lake nearly 1.6 kilometers (one mile) long that extends from the northeastern quarter of Section 11 (Township 5S, Range 1W) into the southwest central portion of Section 1 (Township 5S, Range 1W)(Figure 5). As depicted, this lake covered the coalesced sink area and the northern portion of the northern trough of the Boundary Canal Basin. Another elongated lake is placed in the Boundary Canal Basin west of Bell Hill, and a stream leads from the south end of this lake to the drainage system in and south of the upper relict Tennessee River terrace. The lake was undoubtedly present, but the connection to the southwest-flowing stream was fanciful, according to topographic and pedologic evidence.

Surface springs and seeps active at present include at least Byrd Spring, a probable seep at the western base of the hill which contains site 1Ma210, and another at the base of the ridge on which lies site 1Ma218. Ephemeral seeps and small springs were probably present along ridge bases and on the slopes of Bell Hill throughout the period of prehistoric occupation.

Subsurface Drainage

Studies of limestone bedrock terrain since medieval times have shown that the subsurface component of drainage is commonly more important to the water budget of an area than the surface component (see review by Stringfield and LeGrand 1969). Several apparent anomalies of the Huntsville Spring Branch system can be explained by assuming that subsurface drainage channels have affected the geomorphology of the area (see below "Hydrology and Landforms"). In brief, the system in Huntsville Spring Branch Basin (and in surrounding basins) involves both the surface drainage noted above, and the much more extensive system of subsurface solution channels in the limestone. Major subsurface channels exist which collect precipitation and meltwater through sinks, interrupted streams, and ground water through permeable soils and jointed rocks. This is demonstrated by the presence of Huntsville Spring, Byrd Spring, and other major springs in the region. Smaller subsurface systems are represented by local seeps and springs. Cavities of various sizes are abundantly present in the Tuscumbia formation, and studies by LaMoreaux et al. (1950), and LaMoreaux and Powell (1960) concluded that an extensive system of joints and bedding planes is the basis of the channel system. Cavities continue to more than 30 meters (100 feet) in limestone bedrock below the Tennessee River (Moneymaker 1941). LaMoreaux et al. (1950:32) note that solution cavities have been detected to some 40 meters (130 feet) below ground surface in the Huntsville area, and that they become "fewer and farther apart" with depth (LaMoreaux 1962:34).

Hydrology and Landforms: Factors which control the production of "karst" topography (i.e., terrain with an abundance of sinkholes, formed on soluble bedrock such as limestone) include 1) presence of soluble rocks; 2) geologic structure; 3) interconnected surface and

underground drainage; and 4) base level (Herrick and LeGrand 1964:30). Studies of karst regions by Herrick and LeGrand (1964) have resulted in a model of the landform evolution. It begins with uplift of strata in which more soluble material is covered by a less-soluble layer, for example, sandstone over limestone as in Cumberland Plateau.

Surface streams eventually breach the overlying, soluble layer (if it is not too thick), and surface and ground water become relatively freely interconnected. Water can then move down through the insoluble material into and through joints and bedding planes in the soluble layer, to base level (i.e., stream). Scarps form and retreat on both sides of the valley (such as those of the Flint River Valley, Doran Cove in which Russell Cave is located, and the Sequatchie Valley), as the edge of the caprock is undermined through solution of the soluble layer. Channels and vertical shafts develop in the soluble material. These form sinks and basins as the surface material becomes thinner and is eventually removed.

In later stages of karst evolution, after the caprock is largely removed, rolling plains can develop on which the landforms are the result of secondary surface processes working on features which reflect their formation as solution channel systems and sinks. Several separate surface drainage systems can be interconnected by a single subsurface system (Stringfield and LeGrand 1969:389). Solution and sink formation continue in the zone of active ground water circulation, which is a function of local base level (Stringfield and LeGrand 1969:356).

When local base level is reduced, through tectonic uplift, sea level falls, or other causes, solution channels and cavities above the water table can become caves accessible to humans. Surface drainage cuts down in response to base level fall, and the zone of active ground water circulation is correspondingly lowered. If base level then stabilizes sufficiently, a new system of solution channels is gradually formed (Stringfield and LeGrand 1969:408).

In the study area and the Indian Creek and Huntsville Spring Branch drainage basins, several features can be explained by the observations and interpretations summarized above. The major depressions (Byrd Spring Lake Basin, Boundary Canal Basin and the connecting lobate sink, and Huntsville Spring Branch Basin) do not resemble normal dentritic drainage systems. Bottomlands with knolls (having secondary chert cores), and the irregular, angular margins of the basins appear to be surface expressions of a complex, collapsed solution channel system. The departure of Huntsville Spring Branch from its own basin, through the upland rim to join Indian Creek, is readily explained as the result of collapse of a subsurface channel system which once connected the two basins. The paucity of natural stream channels observed in swales apparently unmodified by channellization, and the absence of evidence for stream channels on the 1937 aerial photographs probably indicates that the upland drainage was largely subsurface. Upland graveliferous subsoils and internal

secondary chert masses both appear to be relatively permeable, affording passage downward for precipitation, which seeps through the overlying soil horizons.

The latest base level change is the historic artificial control of base level. Wheeler Lake level especially affects the water tables and nature of flooding in the Indian Creek and Huntsville Spring Branch basin bottomlands. It is possible (but considered unlikely) that all of the layer of recent alluvial and colluvial deposits detected in backhoe trenches in the bottomlands and on their margins (see above "Huntsville Spring Branch Basin", and "Boundary Canal Basin and Adjacent Uplands") has been deposited since the formation of Wheeler Lake. However, this is unlikely for two reasons. The first is that Wheeler Lake, although it tends to maintain high water levels in the tributary basins, extends the duration of flooding episodes in the basins, but does not greatly alter erosion and deposition processes which were present in the natural system. The second reason follows from the assumption that the recent bottomland sediment layer does represent only post-Wheeler Dam deposition. In that case, there is a complete lack of any material which might represent the preceding 75 years of erosion and deposition which accompanied the land clearing for agriculture.

7. PROJECT METHODOLOGY

By

Prentice M. Thomas, Jr.

Reconnaissance Survey

Sampling Strategy

Any sampling strategy can and should be based upon the demands of the research design. In order for the research hypotheses to be validated or nullified, the sampling strategy must be so formulated as to address all aspects of the design. The theoretical orientation of the Redstone Arsenal cultural resources reconnaissance required the systematic sampling of all landforms and environments in order to determine patterns of settlement and to properly define site location strategies. To achieve these goals a systematic aligned random sample procedure was instituted. As fully described by Plog (1976), such a procedure insures the systematic coverage of all areas within a universe, and assumes that all environmental variables in question have an equal chance of occurring in any given locality.

The cultural resources reconnaissance consisted of a sample survey of 20 percent of the project area. Implementation of the sampling procedure was accomplished by dividing the approximately 14 square mile study area into 46 units. Thirty-four of these units represent whole one-quarter sections (160 acres, 64.75 ha), while the remaining 12 units were only partial quarter sections, owing to the irregular shape of the project corridor. A 20 percent sample of the 46 units, 9.2 units, was chosen. In order to generate the sample selection, one unit within the first five was chosen at random (Unit 4). The remaining units were then chosen following a systematic, aligned methodology based upon the selection of every fifth unit. The number five was selected by simply dividing the matrix number by the sample size (46 : 9.2 = 5)(Figure 21).

Following this sampling schedule, nine units were selected for survey and include 4, 9, 14, 19, 24, 29, 34, 39, and 44. One of these, 34, had to be eliminated due to landowner's refusal to permit access. In its place, unit 30 was substituted since this unit most closely conformed to the topographic features present in the formerly selected unit 34. In addition to the nine units selected according to the sampling schedule, two additional units were selected and examined in the field, thus affording some additional survey coverage. This judgemental selection included units 13 and 17.

The sample survey of nine units, combined with the additional judgemental survey of two units, brings the total area surveyed to 28.53 percent of the study area. The total area surveyed in complete or partial units was 1993.8 acres (806.87 ha). Other than the survey

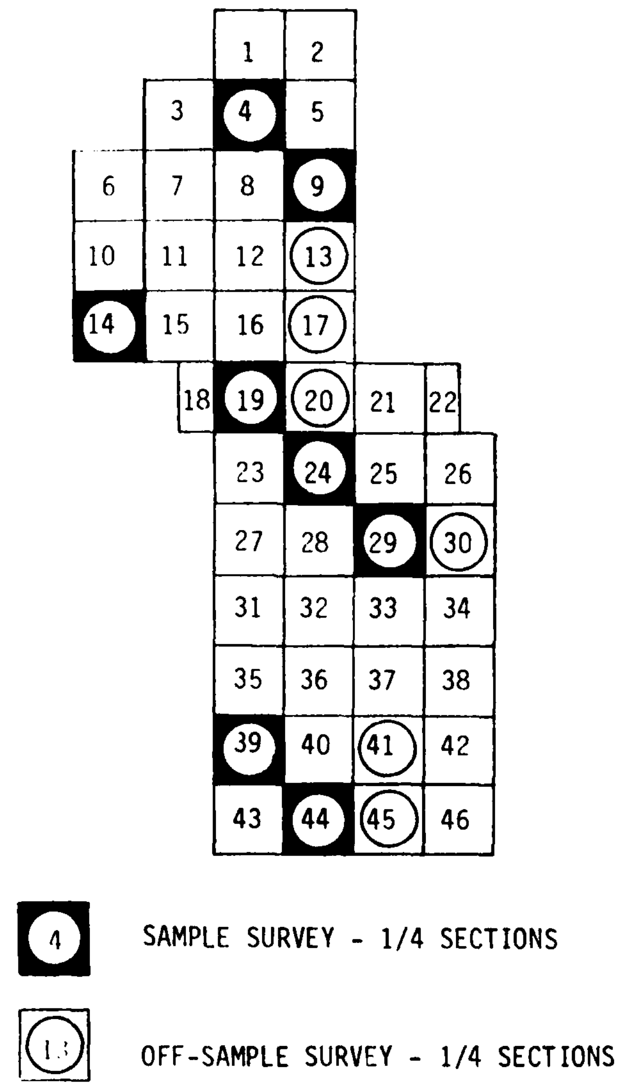


FIGURE 21. MAP ILLUSTRATING THE SAMPLE AND OFF-SAMPLE SURVEY UNITS.

of the 11 units, additional coverage was obtained while walking to and from some survey units. Also, while testing the known sites (to be discussed below), reconnaissance of the surrounding areas led to the discovery of one new site.

Fieldwork in all of the units was approached in fundamentally the same manner. The survey was conducted by a two-person crew, with each survey unit being located using physical (topographic) and plotted landmarks. A general vehicular reconnaissance of each unit was conducted prior to the pedestrian survey. Following this reconnaissance, survey proceeded in each unit with crew members spaced at 30 meter (98 feet) intervals along transects, usually oriented in a north-south direction. Survey continued along each transect until the end of the unit or until standing water or swamp forced a cessation of the transect. In cleared fields or areas with little ground cover, the surface was visually inspected for the presence of artifactual materials. In areas where the surface was partially or wholly covered by vegetation due to pasture cover, understory, or humus, shovel pits were placed at 30 meter (98 feet) intervals along the transect lines. Each shovel pit was approximately 40 to 50 cm (1.31 to 1.64 feet) in diameter and reached a depth of about 30 cm (11.9 inches) below the surface.

In addition to the transect coverage, knolls, ridges, or other likely locations for site occurrence were examined in detail. Additional shovel pits were placed along the edge of swamps or shorelines. As the transect survey proceeded, any cultural features ranging from isolated artifacts to standing historic structures, were noted on the unit base map. However, the definition of a site, for both prehistoric and historic remains, was defined on particular criteria established at the outset of the project. For prehistoric sites, the presence of three or more artifacts per 100 meters (328 feet) was classified as a site.

A historic site was defined on the basis of a concentration of historic artifactual materials, standing structures, evidence of structures such as foundation lines, building materials, etc., or surficial features such as wells, corrals, orchards, or hedgerows.

Once identified, the sites were revisited by a larger crew at which time the limits of the site were determined and site data were recorded. First, an informal unstructured search was made to get a general idea of site size and configuration and to search for diagnostic artifacts. If found, these were collected. Following the informal reconnaissance, site extent was determined by a radial transect survey in which eight radials were laid out from an approximate site center; or, depending upon the configuration of the site, linear transects were run. Each radial or linear transect was walked by an archaeologist who made systematic surface collections at regular five-meter (16.4 feet) intervals. If the ground surface was obscured, shovel pits were sunk at five-meter (16.4 feet) intervals. The horizontal limits of the site were usually determined by the cessation

of artifacts for 15 consecutive meters (49 feet). However, in some cases, topography was also considered in defining site limits, particularly when the sites were located on bottomland knolls.

Artifact density contour maps were prepared for each site, based on the results of the radial or linear transect survey. Photographs were taken of each site, and site forms were completed. All sites were plotted on USGS quadrangle maps and within Redstone Arsenal, on the Basic Information Maps.

Isolated artifacts, considered as any loci with three or less artifacts within a 100 meter (328 feet) square area, were treated in a slightly different manner. These loci were recorded in the field notes, plotted on the unit maps, and collected. However, site forms were not completed on such isolated surface artifacts with no apparent associations.

Survey Results

The survey located 22 formerly unreported sites, 19 in survey units and three located outside the survey units. Temporally, these sites range from the Paleo-Indian period through the Historic period, and include several multiple component sites.

Fourteen of the new sites are located in the nine systematically selected sample survey units, while five are located in the judgementally selected units. The remaining three are located in survey units not included in the sample. One of these latter sites was discovered by Mr. Lawrence Alexander, who showed us the location. A second was located while testing site 1Ma190, and the third was found while proceeding to a survey unit.

In addition to the new sites, seven previously recorded sites are located in the survey sample units, bringing the total number of sites in the 11 survey units to 26. Based on the total survey coverage of approximately 1993.8 acres (806.87 ha), these totals indicate an overall site density of one site per 76.6 acres (31.0 ha).

Test Excavations

Procedures

The goal of this phase of the project was to provide sufficient site information to evaluate known sites and newly discovered sites for eligibility to the National Register of Historic Places. Sites known at the outset of our investigations included three sites (1Ma31, 1Ma32, and 1Ma33) recorded in the 1930s during the survey of the Wheeler Basin (Webb 1939; Day n.d.a, n.d.b, n.d.c). In addition to these sites, H. Summerfield Day reported two sites (1Ma49 and 1Ma50) during his work in the area in 1941 (Day, n.d.c, n.d.d, n.d.e, n.d.f). In 1979, a survey conducted by the Office of Archaeological Research (O.A.R.), University of Alabama, located 13 sites (1Ma133, 1Ma140,

1Ma141, 1Ma142, 1Ma152, 1Ma153, 1Ma154, 1Ma155, 1Ma156, 1Ma157, 1Ma158, 1Ma159, and 1Ma162) in the project area (Alexander 1979). Finally, there are five sites which were recorded by Alexander and which are on file with O.A.R., that are not noted in the 1979 report. Because of the proximity to one another of 1Ma31 and 1Ma32, and 1Ma33 and 1Ma50, these four sites were treated as two discrete loci, 1Ma31/32 and 1Ma33/50. This brings the total number of known sites in the project area to 21.

Each of these 21 sites was included in the testing program. In addition, five sites were selected for testing from those newly discovered during the sampling survey portion of the project. The selection of sites for testing was based on the survey data and was designed to include sites judged most likely to be of significance or sites that were separated by some distance from any previously tested sites. The newly discovered sites tested for significance were 1Ma209, 1Ma210, 1Ma212, 1Ma216, and 1Ma220. Thus, testing was conducted at a total of 26 sites.

The testing methodology implemented at the 26 sites was systematic and designed to produce comparable data from each site. The standard procedures were altered in only a few instances, with variations dependent upon site specific conditions. The standard strategy employed at each site was as follows. At each site, the testing program was initiated by conducting a radial transect survey to determine site size with precision, and to delineate areas of artifact density. During testing, a series of eight radial transects were laid out from an arbitiary centerpoint. As with the survey procedure, an archaeologist walked each transect and collected surface artifacts every five meters (16.4 feet). At each collection station, an area measuring about one meter (3.28 feet) square was examined and collected. Shovel pits were used in areas where the surface was obscured. The collection ceased when artifacts terminated.

At the larger sites radial transects were deemed impractical, and linear transects were substituted. At these sites (1Ma31, 1Ma32, 1Ma33, 1Ma50, 1Ma141, and 1Ma210), the linear transects were spaced 15 meters (49 feet) apart and collection of a one-meter (3.28-feet) square area was made at five meter (16.4 feet) intervals along each transect. The only other deviation from the transect procedure occurred at sites 1Ma142 and 1Ma182, where, because of oddities in site configuration, two sets of radial transects were surveyed in order to ensure accurate site delineation.

Following the surface collection, each site was plotted on the USGS 7.5-minute quadrangle maps, and on the Redstone Arsenal Basic Information Maps. In addition, a sketch map of each site was prepared in the field showing prominent terrain and surface features and the location of the centerpoint. Third, based on the transect collections, an artifact density map was made in the field showing areas of artifact concentration and site limits. Both the sketch and artifact density maps are included within the site descriptions.

Two one meter (3.28 feet) square test pits were placed at each site and excavated to sterile deposits. The excavations proceeded by 10 centimeter arbitrary levels unless natural stratigraphic breaks were observed, in which case excavation proceeded by natural levels. All dirt was screened through 1/4" hardware mesh and artifacts bagged according to provenience.

Deviation from the standard procedure of placing two test pits at each site occurred at site 1Ma141, where, because of its location on the bank of the Tennessee River, it was deemed sufficient to cut bank profiles and take column samples from each stratum thus exposed. A similar profile exposure was made in the eastern portion of site 1Ma31/32. For the purposes of our field investigations, sites 1Ma31 and 1Ma32 were considered a single site because of their proximity. Likewise, sites 1Ma33 and 1Ma50 were considered as one. In both instances, only two test pits were placed at each. No test pits were located at site 1Ma49, an isolated mound that was completely excavated by H. Summerfield Day. Finally, four test pits were located at site 1Ma182, two in each sector of the site.

The test excavations provided data on site stratigraphy and, combined with the radial and linear transect collections, a sample of artifactual material. In addition to these procedures, more intensive testing was undertaken at some of the sites in an effort to determine if intact subsurface features were present.

At sites located in cultivated fields and at which subsurface features were likely, a gradall was employed to strip the plow zone from an area measuring five meters (16.4 feet) by six meters (19.6 feet). The gradall was used at six sites, 1Ma140, 1Ma157, 1Ma158, 1Ma159, 1Ma190, and 1Ma210 (Plates 13 and 14).

Unfortunately, at numerous sites located in cultivated fields, access was a problem due to the severely wet conditions. In cases where additional subsurface testing was deemed necessary for evaluation, but access problems precluded use of the gradall, a mechanized auger was used to place a series of subsurface tests. The usual procedure was to place the auger holes along three transects crossing the center of the site. As in the linear transect surveys, the transects were located 15 meters (49 feet) apart and the holes were placed at 5 meter (16.4 feet) intervals along each transect. Following this procedure, auger holes were placed at seven sites, 1Ma142, 1Ma154, 1Ma180, 1Ma182, 1Ma183, 1Ma209, and 1Ma212. Also, augering was initiated at site 1Ma133, but was terminated when an intact feature was found.

Subsurface tests with the gradall and auger were not undertaken at sites shown by earlier excavations or our investigations to contain intact deposits (1Ma31, 1Ma32, 1Ma33, 1Ma49, 1Ma50, 1Ma141, 1Ma156, and 1Ma162). Also, no such tests were undertaken at six sites which contained extremely low artifact densities and/or could not be reached during the final days of the project due to extremely wet conditions.

PLATE 13. GRADALL OPERATION AT 1Ma157.

PLATE 14. THE MAPPING PROCEDURES CONDUCTED IN THE CUT AT 1Ma210. NOTE THE UPRIGHT FLAGS MARKING PRESUMED POSTMOLD LOCATIONS.

These sites include 1Ma152, 1Ma153, 1Ma155, 1Ma181, 1Ma216, and 1Ma220.

Each of the sites recorded during the reconnaissance survey and all of the sites investigated during the testing phase of the project are discussed in detail in Chapter 8.

END